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REPORTS OF THE
PRINCETON UNIVERSITY EXPEDITIONS
TO PATAGONIA, 1896-1899

J. B. HATCHER
IN CHARGE

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Reports of the
Princeton University Expeditions to Patagonia
1896-1899

VOLUME V.

MAMMALIA OF THE SANTA CRUZ BEDS

I. Edentata
II. Insectivora
III. Glires

BY
WILLIAM B. SCOTT
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MAMMALIA OF THE SANTA CRUZ BEDS.

PART I. EDENTATA.

BY

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INTRODUCTION.

FROM many points of view the fossil mammals of the Santa Cruz formation are of remarkable interest. They present a number of unusually instructive phylogenetic series and throw much welcome light upon the manner in which the evolution of the Mammalia has been accomplished. Further, they bring up questions of profound and far-reaching importance, concerning their relationships to the animals of the northern hemisphere, as well as to those of Africa and Australia. With these questions are connected the problems of geographical distribution and of the migrations of land animals, the former extent and connections of the continents, in brief, the whole mystery of the southern hemisphere.

The able writings of Dr. F. Ameghino have directed the attention of palæontologists to these and kindred questions, but, unfortunately, this wonderful Santa Cruz fauna has hitherto been but scantily represented in the museums of Europe and North America, and, in consequence, students of the Mammalia could gain only a very imperfect knowledge of these animals from brief diagnoses and inadequate illustrations. In order, therefore, to render the material useful to those who cannot examine the originals, an otherwise unnecessarily minute prolixity of description and fulness of illustration have seemed to be called for. This course is further made advisable by the extraordinary variability of many of these mammalian groups, which renders the usual systematic treatment so unsatisfactory when applied to them.

It has been my privilege to study all of the principal collections of Santa Cruz fossils, including almost all of the types. These collections are, in addition to the one at Princeton, those of the American Museum of Natural History, New York, the Munich Museum, the British Museum, the La Plata Museum, and, most important of all, the private collection of Dr. F. Ameghino. Abundant use has been made of the free permission accorded me to figure and describe such material as suited my purpose.

As this volume may fall into the hands of some who will have no opportunity or occasion to consult Volume I of these Reports, it will not be superfluous to repeat here a number of statements from the general editorial preface.

In the spring of 1901 the writer found it necessary "to visit the Museums of La Plata and Buenos Aires and study the collections there gathered. He is glad of this opportunity to express his feelings of profound gratitude to those who did everything in their power to render these investigations helpful and satisfactory.

"Dr. Florentino Ameghino, now director of the National Museum at Buenos Aires, but then living in La Plata, permitted the freest possible use of his great private collection of Patagonian fossils, a collection which is especially valuable because it contains by far the largest number of the type specimens of the genera and species named from Patagonian horizons.

"Dr. F. P. Moreno, Director of the La Plata Museum, . . . placed his museum and all its resources unreservedly at the disposal of the visitor, who, living in the building for several months, enjoyed its hospitality in the most literal sense of the word. The Secretary of the Museum, Sr. R. Catani, and the Curators, Dr. Santiago Roth, Professor R. Hauthal, Dr. R. Lehmann-Nitsche and Sr. Carlos Bruch, were indefatigable in their assistance, and most hearty thanks are due to each and all of them for countless instances of helpful kindness."

In addition, I wish to express my cordial thanks to my friend, Professor H. F. Osborn, who has given me unrestricted use of the fine collection of Santa Cruz fossils, made for the American Museum of Natural History by Mr. Barnum Brown. This collection admirably supplements that made by Messrs. Hatcher and Peterson for the Museum of Princeton University. How extensively this collection has been employed will be apparent from the plates.

Finally, I must make grateful and appreciative mention of the help rendered by my assistant, Dr. Marcus S. Farr, by Mr. Jacob Geismar, preparator, and by Mr. F. van Iterson, artist, who have labored with unwearied zeal and without whose assistance the work could hardly have been undertaken.

EDENTATA OF THE SANTA CRUZ BEDS.

Following the suggestion of Oldfield Thomas ('87, p. 459) the Edentata will be here regarded as forming a separate subclass of the mammals, and in what follows no account will be taken of the so-called edentates of the Old World, the position of which is altogether uncertain. Discussion of the systematic position of the subclass, as a whole, and of the mutual relationships of its various subdivisions will be deferred until a detailed account of the Santa Cruz representatives of the group shall have been laid before the reader. It is my purpose in the present section merely to consider the more salient characteristics of the fossils. The following table gives the scheme of classification here adopted.

I. DASYPODA.
    1. *Tatuidæ.*
    2. *Dasypodidæ.*
    3. *Chlamydophoridæ.*
    4. *Peltephilidæ.*

II. GLYPTODONTIA.
    1. *Sclerocalyptidæ.*
    2. *Glyptodontidæ.*
    3. *Dœdicuridæ.*

III. GRAVIGRADA.
    1. *Megalonychidæ.*
    2. *Megatheriidæ.*
    3. *Mylodontidæ.*

IV. TARDIGRADA.
    1. *Bradypodidæ.*
    2. *Cholœpidæ.*

V. VERMILINGUIA.
    1. *Myrmecophagidæ.*

In the Santa Cruz fauna the edentates form one of the most conspicuous elements, both in the abundance of individuals and in the number and variety of the genera and species. As a whole, they are strikingly different from those of recent times, for of the three orders which are represented among the fossils, armadillos, glyptodonts and ground-sloths, only the first-named persists to the present day, the other two being extinct. On the other hand, no trace has yet been found in the Santa Cruz beds of the true sloths or of the anteaters. It can hardly be doubted that both of these orders had already become differentiated and were in existence as such. If so, however, they must have originated in some other part of the South American continent and were prevented by climatic, or other barriers from extending their range into Patagonia. One fact which clearly justifies this assumption is the relatively small degree of structural change that took place between the edentates of the Santa Cruz and those of later periods, such as the Pampean. There are many differences of detail between the earlier and the later forms, but nothing comparable to what would be implied in the derivation of the sloths or anteaters from any known Santa Cruz fossils.

As will be shown more at length in a later section, much the same statement applies to the armadillos of the Santa Cruz beds, with reference to their connection with those of modern times. Speaking broadly, the latter would appear not to have been derived from the former, which suggests that Miocene Patagonia was rather an outpost of the South American fauna than the main area of its development.

The Santa Cruz glyptodonts are, on the whole, markedly more primitive than those of the Pampean and in many structural details show a closer connection with the armadillos than do the latter, but, for the most part, the Santa Cruz genera do not appear to be directly ancestral to those of the Pampean. Like the armadillos, they seem to be aside from the main lines of descent which terminated in the giant types of the Pleistocene.

On the other hand, the Gravigrada appear to be more directly ancestral to the great Pampean forms, and representatives, if not the actual ancestors, of almost all the later genera may be observed in this fauna. However, no entirely convincing solution of these problems can be obtained until the fossils intermediate in time between the Santa Cruz and the Pampean are more fully known.

A remarkable feature of the Santa Cruz edentates is their variability within certain well-defined limits. As a rule, the genera may be readily identified, but the species, especially of the Glyptodontia and Gravigrada, present extraordinary difficulties to the systematist. This variability, however, confines itself to comparatively unimportant details, and the characteristics of the three orders and of the families and genera within those orders are already, for the most part, firmly established, though transitional forms from species to species and, less commonly, from genus to genus abound.

1. The Santa Cruz edentates are relatively small animals and a few of them are really minute. As compared with the ground-sloths and glyptodonts of the Pampean, they are pygmies, but the armadillos have a greater number of large species than exist at present, though none of them is gigantic, or comparable to such a form as *Macroeuphractus*.

2. Fully developed carapaces are found in all of the armadillos and glyptodonts of the period, but, as yet, no dermal ossifications have been found in connection with any of the ground-sloths. This is the less surprising, because very little is known of the skeleton of the Santa Cruz *Mylodontidæ*, the only family in which these ossifications could be expected to occur.

3. The teeth are in all cases devoid of enamel, rootless and tubular, though they may be lobate, examples of which occur in all three of the orders. No trace of a milk-dentition has been observed. Premaxillary teeth and the corresponding mandibular teeth have been definitely found only in the armadillos, though rudimentary traces of such teeth are apparent in some of the glyptodonts and they may also occur in a few of the ground-sloths.

4. The skull has few common features throughout the series, each order having its own characteristic type of structure. The difference is largely in the relative development of the cranial and facial regions, which varies from the extremely elongate skull, with long, slender rostrum, of the armadillos, to the short, broad, deep and almost cubical skull of the glyptodonts. Sagittal and occipital crests are never very strongly marked, but they are present in most genera of all three orders and there is no such development of cranial air-sinuses as took place at a later period. In all of the known genera from this formation except *Peltephilus* there is a more or less prominent descending, suborbital process given off from the zygomatic arch; it may be formed by the jugal alone or by the jugal and

maxillary, and in position it may be at the anterior or the posterior end, or in the middle of the arch. The arch itself is always complete, never rudimentary, though in the Gravigrada the jugal is usually loosely attached and has been lost from most of the specimens.

5. The neck has never more or less than seven vertebræ, though in all of the armadillos and glyptodonts the apparent number is much reduced by coössification. In the same two groups the trunk is short and the number of trunk-vertebræ small and in the glyptodonts these vertebræ are coössified into long "tubes," one thoracic, the other lumbo-sacral. In the Gravigrada, on the contrary, the trunk is very long and the trunk-vertebræ numerous. In both armadillos and ground-sloths the lumbar and posterior thoracic vertebræ have very complex accessory zygapophyses, which in the former are as fully developed as at the present time, but in the latter are somewhat less so than they became at a later period. The sacrum may be long (Dasypoda, Glyptodontia) or short (Gravigrada) but always articulates with both ilia and ischia. The tail is sometimes of moderate length and sometimes very long, but is always heavy and always has a complete series of chevron-bones.

6. The limbs and feet differ greatly in the three orders and have comparatively little in common. The scapula is broad and has an extremely prominent spine and acromion; the coracoid is very large in the ground-sloths, reduced in the glyptodonts and armadillos, except *Peltephilus*. In all three orders the humerus has a similar general appearance, having small tuberosities, extremely prominent deltoid and supinator ridges and internal epicondyle, while the foramen is large. Ulna and radius are separate and, except in the ground-sloths, the former has a very large olecranon. All the carpals are free, but no genus has been found which has the centrale. The manus is pentadactyl and plantigrade, though it is not improbable that the Gravigrada had already begun to rest the ulnar edge of the hand upon the ground; the metacarpals are free and, except in one species of armadillo, none of the phalanges are coössified. The unguals are generally longer and more pointed than in the pes.

The pelvis differs much in the three groups, but the ischia are always extensively connected with the sacrum. The femur is long and has prominent trochanters and in some of the armadillos the great trochanter reaches extraordinary proportions. Tibia and fibula are free in the Gravigrada, coalesced at both ends in the glyptodonts and armadillos. The pes is pentadactyl and, except in the glyptodonts, is plantigrade, while in the latter group it is semidigitigrade. No coössification occurs in tarsus, metatarsus or phalanges, and the unguals, which in the ground-sloths are large claws, in the other two orders are more or less hoof-like, completely so in the glyptodonts.

DASYPODA.

The Santa Cruz armadillos form a peculiar assemblage of types, very unlike, as a whole, the modern representatives of the suborder, for only one, or possibly two, species would appear to be directly ancestral to existing forms, while the majority belong to extinct lines. Some of these lines, like that of *Proeutatus*, for example, persisted till a much later period than the Santa Cruz, and reached their culmination in the Pampean, but have no representatives in the recent fauna, while other series, like *Stegotherium* and the extraordinary *Peltephilus*, are not known to pass beyond the limits of the Santa Cruz formation. At the same time, there is a very notable diversity among these armadillos and no less than three families and seven genera have been described, most of the genera hav-

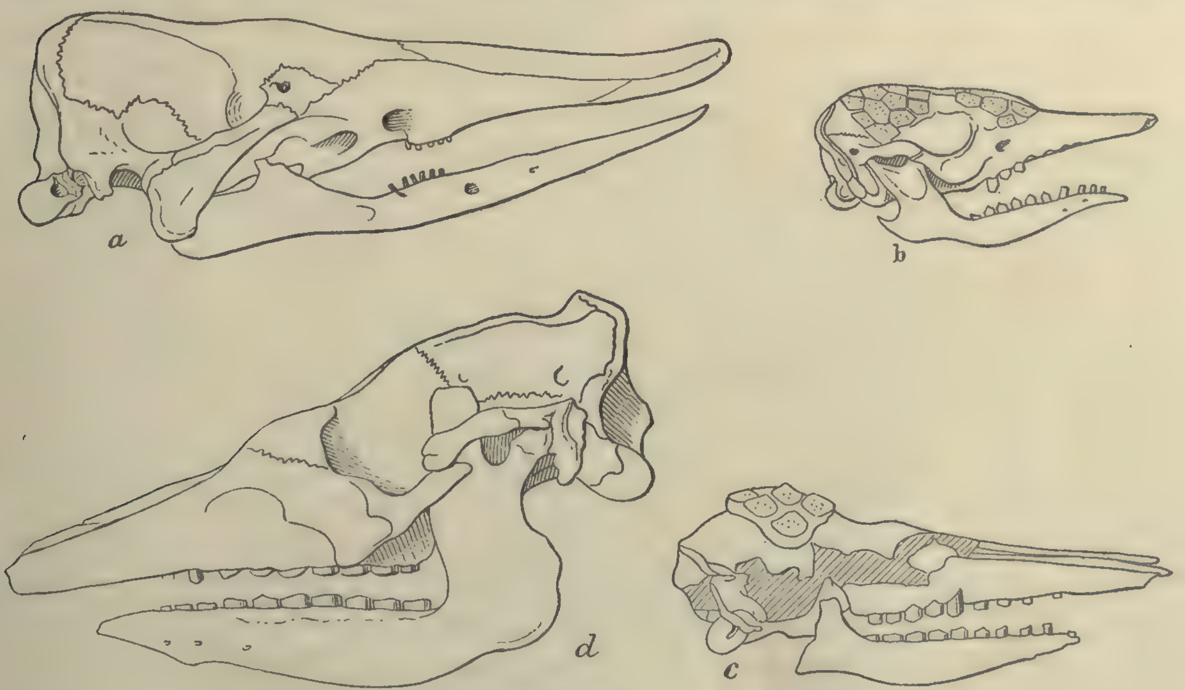

FIG. 1.

Skulls of Santa Cruz armadillos, × ⅜. *a, Stegotherium tesselatum ; b, Prozaëdius exilis ; c, Stenotatus patagonicus ; d, Proeutatus lagena.*

ing each several species. The discovery of more complete material may reduce these numbers, but the variety will continue to be remarkable.

Attention has already been called to the difference between the Santa Cruz and the recent armadillos, a difference which can be made clear in a few words. No probable forerunner of *Dasypus*, *Priodontes*, *Tolypeutes*, *Chlamydophorus*, or *Tatu*, has been found in these beds, though some one of the species of *Prozaëdius* was almost certainly an ancestor of the recent *Zaëdyus*, and it is possible, though far from certain, that some species of *Stenotatus* stood in the same relation to the modern *Cabassous*. In view of the stage of differentiation attained by the Santa Cruz armadillos, it is most improbable that all of these modern types should have originated since that period. This confirms the conclusion indicated by several other mammalian series, that in Miocene times Patagonia was not the principal theatre of evolution of the South American fauna. This would explain the entire absence from the Santa Cruz beds of many types which would naturally be expected to occur there.

In general, the armadillos of this period may be said to have attained nearly the modern degree of specialization, though, in many details, primitive characteristics have been retained. As Ameghino has pointed out, ('94, 178) the carapace never has an anterior buckler, but is made up of movable, imbricating bands, except posteriorly, where a larger or smaller number of plates are joined together by their edges to make the pelvic buckler. In one genus, *Præuphractus*, (*fide* Ameghino) there is no pelvic buckler, all the plates being movable, and it is uncertain whether this was not also true of *Stegotherium*. In *Peltephilus* the pelvic buckler would appear to have been very loosely formed, the plates merely touching one another, though in this region they are not imbricating. The cephalic shield is usually composed of numerous small, non-imbricating, irregularly polygonal and rather heavy plates, which are finely pitted and display no regular sculptural pattern, but in the altogether exceptional genus *Peltephilus* these plates are large, very thick and coarsely sculptured. A further remarkable peculiarity of the head-shield in this genus is the presence of one or two pairs of pointed, horn-like scutes upon the rostrum. It is a curious fact that no plates of the tail-sheath have been found in association with any of the genera, except *Peltephilus*. It seems most unlikely that all the other genera had unarmored tails and yet, in view of the large number of well-preserved specimens, including the caudal vertebræ, that have been collected, it is possible that such may have been the case.

Considerable variety is displayed in the dentition, though in no species has any trace of enamel or of the milk-teeth been observed. The marked diphyodontism of the modern *Tatu* makes this fact somewhat surprising. Premaxillary teeth and the corresponding mandibular teeth occur in two genera, *Proeutatus* and *Peltephilus*, and in the latter they are so closely approximated that the teeth of both upper and lower jaws form a continuous series. *Prozaëdius* and *Stenotatus* have teeth like those of most recent armadillos, while in *Proeutatus* the teeth show an incipient division into lobes and have a complex masticating surface, produced by layers of dentine of different hardness and color, and with some resemblance to the teeth of the glyptodonts. In *Peltephilus* the teeth are sharply pointed and form what appears to have been a formidable lacerating apparatus, while, finally, in *Stegotherium* the dentition is in such an extreme state of reduction that the animal must have been functionally all but edentulous.

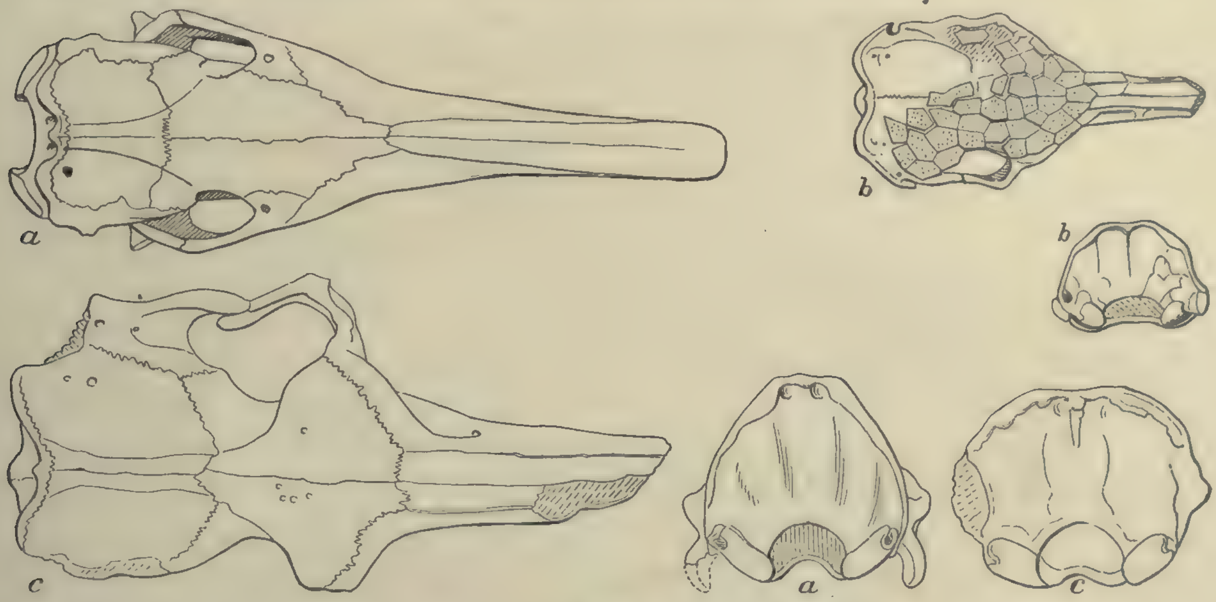

FIG. 2.

Skulls of Santa Cruz armadillos, × ⅔. *a*, *Stegotherium tesselatum* ; *b*, *Prozaëdius exilis* ; *c*, *Proeutatus lagena.*

In all the known genera, except *Peltephilus*, the skull has a very elongate and usually a slender rostrum, and, with the same exception, the zygomatic arch has a prominent descending, suborbital process, which is generally from the jugal, but sometimes from the zygomatic process of the maxillary also.

The cervical vertebræ closely resemble those of the modern armadillos, one or two vertebræ coalescing with the axis. The trunk is short and in those genera in which the number is known does not contain more than eleven thoracic and four lumbar vertebræ; in the lumbar and the posterior part of the thoracic regions, the vertebræ have the same complex mode of articulation, by means of accessory zygapophyses, as is found in recent genera. The sacrum is long and always has an extensive union with the ischia. The tail varies considerably in the different genera; it is usually quite elongated, but in some of the genera, as *Proeutatus*, it is of only moderate length, though very heavy; in *Stegotherium* the caudal vertebræ are remarkable for the great development of their transverse processes. The ribs, both costal and sternal, and the sternum differ in no important respect from those of the recent armadillos.

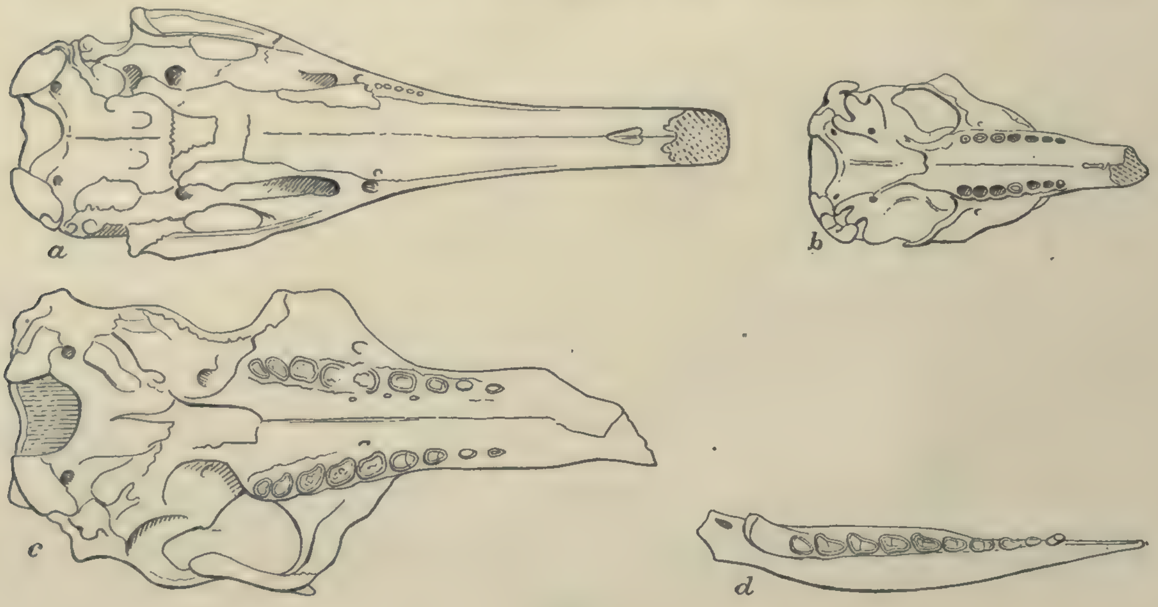

FIG. 3.

Skulls of Santa Cruz armadillos, × $\frac{2}{3}$. *a*, *Stegotherium tesselatum*; *b*, *Prozaëdius exilis*; *c*, *Proeutatus lagena*; *d*, mandible of *P. œnophorus*, crown view of right ramus.

The shoulder-girdle is practically the same as in the existing genera, but the humerus is noteworthy for the great size and prominence of the deltoid ridge, and the epicondylar foramen is always present. The ulna has a very large olecranon, which in most of the species terminates proximally in a prominent, incurved hook. The manus is always pentadactyl and all the digits bear claws; in all known species the second digit is the longest of the series. In only one genus, *Stenotatus*, are any of the phalanges coössified. The ungual phalanges are always long, heavy, decurved and pointed, and were evidently well adapted to burrowing habits.

The pelvis varies considerably in the different genera, but does not depart widely from the modern type. The femur is elongate and has a very prominent great trochanter, which in *Proeutatus* reaches remarkable proportions, the third trochanter is also well developed in all cases. As in the recent armadillos, the tibia and fibula are invariably coössified at both the proximal and the distal ends. Like the manus, the pes is always pentadactyl, though in some of the genera, and especially in *Peltephilus*, the lateral digits are much reduced. The ungual phalanges are usually much shorter and broader than those of the manus and are often more like hoofs than claws.

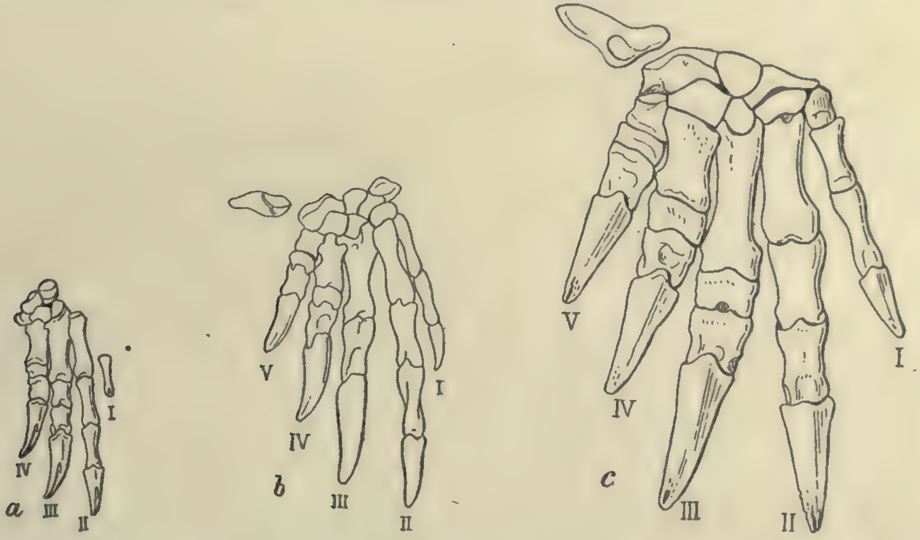

FIG. 4.

Right manus of Santa Cruz armadillos, × $\frac{2}{3}$. *a*, *Prozaëdius exilis*; *b*, *Stenotatus patagonicus*; *c*, *Proeutatus robustus*.

In size, there is much variety among the Santa Cruz armadillos, ranging from the minute *Prozaëdius* to *Proeutatus*, some species of which are larger than any existing armadillo, except *Priodontes*, while the very incompletely known *Peltephilus grandis* may have equalled or even surpassed the latter.

To sum up: The Santa Cruz armadillos differ comparatively little in appearance or in structure from the modern ones, and yet it is apparent that they do not, as a whole, represent the main line of descent which ended in the recent genera. That evolution must have taken place in some other region of the South American continent, doubtless the same region as that which gave rise to the true sloths and the anteaters.

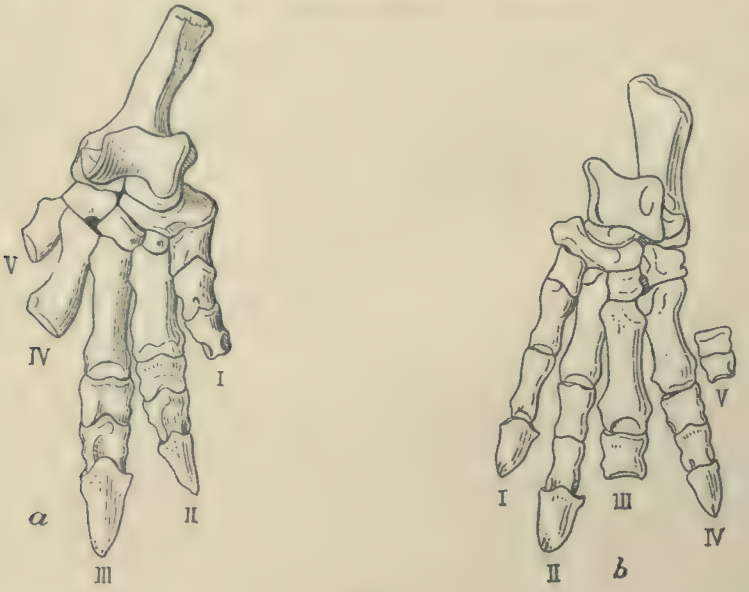

FIG. 5.

a, Right pes of *Stegotherium tesselatum*, × $\frac{2}{3}$; *b*, left pes of *Proeutatus lagena*, × $\frac{2}{3}$.

TATUIDÆ.

STEGOTHERIUM Ameghino.

(Plates I–IV.)

Stegotherium Amegh.; Enumeracion sistematica de Mam. Fos. de Patagonia, 1887, p. 25.

Scotæops Amegh.; Ibid., p. 25.

Peltephilus Lydekker, in part; Anales del Museo de La Plata, 1894, T. III, p. 67.

In Ameghino's first paper on the Santa Cruz fauna ('87*b*) he named two genera of edentates, which seemed to have nothing in common. One of these, *Scotæops*, was described from a fragment of the mandible, which included the alveoli of two teeth and a part of the ascending ramus. The second genus, *Stegotherium*, was founded upon a number of isolated scutes of the carapace, of quite peculiar type. In a subsequent publication ('94*a*) the former was referred to the Monotremata, while the latter was regarded as most nearly allied to *Peltephilus*. Until the collections made by Messrs. Hatcher and Peterson, no additional specimens of these extraordinary animals, other than scattered plates of the carapace, had been obtained. On examining the drawings and notes which I had taken with me to La Plata, Dr. Ameghino at once expressed the belief that these two supposedly different genera were really one and the same, a belief which has been abundantly confirmed by the material in the Princeton collection. In his last paper on the subject ('02, p. 65) the original describer has formally retained the name *Stegotherium* and treated *Scotæops* as a synonym.

In the Princeton collection the genus is represented by two specimens which seem referable to *S. tesselatum*, for though they may possibly represent two different species, the differences between them are more probably due to individual variation. Of these specimens, one (No. 15,566) comprises the greater part of the carapace, about half of the skull, the atlas, the compound cervical, seven thoracic and four lumbar vertebræ, the sacrum and all of the caudal vertebræ, save the three or four terminal ones, together with two ribs, the scapula, humerus, pelvis, femur, tibia and fibula. The second specimen (No. 15,565) has the anterior portion of the carapace, the skull complete, the neck except the sixth and seventh cervicals, two thoracic vertebræ, and the right pes.

Carapace.—The carapace differs quite markedly from that of any other known Santa Cruz genus. I am unable to say whether a pelvic buckler was formed or not, but it is clear that there was no anterior buckler, and in one of the specimens twenty movable bands may be counted in position (Plate I). In the anterior region the scutes are smaller and thicker, and their exposed portions have a more nearly square outline than those of the middle region; in longitudinal section these scutes are lozenge-shaped, with long diameter in the fore-and-aft direction and with no notable difference in thickness between the exposed and covered portions of the plates. Indeed, in this region there is but a partial imbrication of the plates and the mobility of the bands must have been relatively slight; only a small change in the character of the plates would be needed to convert this portion of the carapace into a fixed scapular shield. In the middle region of the carapace the plates are much elongated, becoming nearly three times as long as they are wide, and each scute is clearly demarcated into covered and exposed portions. The anterior, covered portion occupies somewhat less than one half of the length of the plate; it is considerably thicker than the exposed portion and, on the dorsal side, the line of junction between the two is marked by the abrupt, step-like descent which is usual in the armadillos. Though the small, square plates of the anterior region of the carapace are thus markedly different from the narrow, elongate plates of the middle region, there is no abrupt change, such as occurs in the genera having a definite scapular buckler, but a gradual transition from one to the other.

The sculpture of the exposed portion of the scutes is very characteristic; the pattern consists of a very low and narrow, but quite sharp, median, longitudinal ridge, which usually pursues an oblique course, and of raised lateral borders, while the whole exposed surface is finely pitted, or granular. Near the line of junction between the exposed and the covered part of the scute is a transverse row of large and conspicuous piliferous pits, which are of somewhat irregular size and shape, the median one usually being larger than the others. The lateral and posterior borders of the plate are also pitted in an almost continuous line, though these pits are much smaller than those of the anterior transverse row. The appearance of the plates seems to indicate that the animal was in life quite thickly clothed with hair.

Dentition. — The teeth, which are of minute size, are of somewhat variable number, even on the two sides of the same skull, and combining the two specimens, we get the formula $\frac{7-5}{8-7}$. These teeth are of cylindrical shape and together occupy but a short space in the hinder portion of the jaws, leaving much the greater portion of the latter entirely edentulous. They are not, as in most armadillos, so bevelled by wear as to have a transverse, median ridge, but are worn obliquely from within outward. So extreme is the reduction of the teeth that they can hardly have had any functional importance.

Skull (Plate II.) — On the whole, the skull has more resemblance to that of *Tatu* than to that of any other existing armadillo, though the elongation of the rostrum and the great attenuation of the jaws produce a certain likeness to *Priodontes.* The cranium is short, broad and high, the face long, slender and tapering, the extremely slender mandible adding but little to the vertical diameter of the face. When viewed from the side, the upper profile of the skull descends forward very gradually and almost uninterruptedly from the occipital crest to the tip of the rostrum, but is made slightly sinuous by the projection of the frontal sinuses, the posterior convexity of the nasals and the upturning of the end of the rostrum. In one of the specimens (No. 15,566) the frontal sinuses are very inconspicuous externally, making this portion of the profile somewhat concave. In *Tatu* the upper contour of the skull is quite similar, though modified by the great development of the frontal sinuses and the maxillary antra.

The occiput is high and inclined forward slightly, broad at the base, contracting regularly and gradually to the top, resembling the occiput of *Tatu* in shape, but is less square in outline, being broader ventrally and narrower dorsally. As a whole, the occipital surface is convex transversely and, in addition, the upper half displays three vertical ridges, of which the median one, for the vermis of the cerebellum, is the most prominent, though decidedly less so than in the recent genus. The lambdoidal crest is almost obsolete, except near the dorsal summit, where it is quite thick and prominent and is emarginated by a broad, rectangular notch, at the bottom of which are two small but very deep, hemispherical fossæ. In *Tatu* a similar, but much less distinct notch is present, while the fossæ are almost obsolete. The foramen magnum is low and wide and, though relatively higher than in the modern genus, is more like that in the latter than that of *Dasypus*, being to a large extent formed by a broad, deep, V-shaped notch of the basioccipital between the condyles.

The bones of the occiput are so completely fused together that their limits cannot be determined with certainty, but they seem to have quite similar proportions to those of *Tatu*. The basioccipital is short and broad, much wider posteriorly than anteriorly, as it expands behind the tympanic and periotic, much as in the last named genus; it is convex transversely — has a low, curved transverse ridge, which is separated by a shallow groove from the margin of the foramen magnum. In one of the specimens there is a faintly marked median keel. On each side of what is probably the line of suture with the basisphenoid, is a prominent, pitted tubercle, doubtless for the recti antici tendons. The posterior part of the basioccipital is bent downward at an obtuse angle, somewhat as in *Tatu*, but more abruptly, and is thicker and more rounded. The exoccipitals are broader than in the modern genus and are so extended that very little of the squamosal is visible from behind, while in *Tatu* much of this bone is so visible. This is one of the few characters in which *Stegotherium* is more like *Dasypus*. The condyles are widely separated and very oblique, rising toward the outer sides; they are less completely sessile than in *Tatu*, being demarcated from the occipital plane by deeper fossæ, and on the ventral side are much more distinctly separated from the body of the basioccipital. In shape, they are transverse semicylinders; the condylar elevation extends out laterally to the borders of the occiput, where it is separated from the squamosal only by a very narrow strip of the periotic, but the articular surface does not extend so far, and is quite deeply invaded by a lateral sulcus; the ventral portion of the surface is produced farther laterally than the dorsal part. There is no paroccipital process nor any space for such a process between the condylar ridge and the periotic. Though the sutures between the supraoccipital and the exoccipitals have disappeared, it may reasonably be assumed that, as in *Tatu*, the former was very large, making up nearly the whole of the occipital surface, and forming the dorsal margin of the foramen magnum and the whole of the lambdoidal crest; a small portion of the bone is bent over upon the roof of the cranium, though less conspicuously so than in *Tatu*, owing to the depth of the median notch.

The periotic is exposed as a narrow strip between the exoccipital and the squamosal; it has about the same relative breadth as in *Tatu* and is perforated by a similar vascular foramen as in the latter, but has no such groove leading into it. Just above the outer edge of the condylar elevation is a small but deep depression in the periotic, which is not present in the modern genus. The mastoid process is short, but distinct, and is closely applied to the posttympanic process of the squamosal; distally it ends in a concavity for the hyoid. The auditory, or petrosal, portion of the periotic is quite large and very superficial in position and is not entirely concealed from view by the tympanic. The latter is small and forms an incomplete ring of bone, C-shaped when viewed from the ventral side; it is almost exactly like that of *Tatu*, but is a little broader, covering more of the periotic.

The basisphenoid, though short and broad, is somewhat longer than the basioccipital and narrows forward slightly; it has a raised line near each lateral border, and these lines converge anteriorly, enclosing a shield-shaped area, with a shallow fossa on each side of the median line, thus giving to the whole bone a very different appearance from the simply convex form seen in *Tatu*. The presphenoid is quite long and broad, very thin and of nearly uniform width, so far as it is exposed in the roof of the posterior nares. The alisphenoid is small and is perforated by the foramen ovale, while its anterior edge forms the hinder border of the foramen rotundum ; the descending process is very short. The orbitosphenoid seems to be somewhat larger, but the limits of the bone are hardly determinable, as both skulls are injured in this region.

The parietals are short and broad, descending farther upon the sides of the cranium than in *Tatu ;* they form no sagittal crest, but only a narrow sagittal area, which widens anteriorly to the frontal suture, and is clearly demarcated from the temporal fossæ by being raised well above them. In *Tatu* this area is broader, but is very obscurely marked, while in the fossil it is conspicuous, as it is not only raised, but its smoothness is in decided contrast to the roughened surface of the remainder of the parietals. Except near the anterior border, the sagittal area is much thickened and filled with cancellous bone.

The squamosal is a large bone, lower, but longer than the parietal, so that it has a considerable connection with the frontal ; the suture with the exoccipital is very short, the squamosal touching that bone by hardly more than a corner, though it has a long suture with the mastoid portion of the periotic, and it takes no share in the formation of the lambdoidal crest. The auditory meatus makes a broad, deep notch in the squamosal. A deep groove extends upon the side of the latter, its ventral and posterior border being formed by a prolongation of the dorsal border of the zygomatic process, though this border is much less elevated than in *Tatu*. The glenoid cavity is altogether different from that of the modern genus, being a narrow, elongate, longitudinal groove, with no trace of a postglenoid process, and resembling that of a rodent rather than that of an armadillo. In *Tatu*, on the other hand, this surface is elevated, square, and nearly plane, and the postglenoid process, though much reduced, is yet distinctly present. The zygomatic process is extremely short, almost as short as in *Tatu ;* it is a shelf-like projection with raised external border which, however, is not nearly so elevated as in the recent genus ; the jugal covers it so that only a small tongue of the bone is externally visible.

The jugal is quite long, forming nearly the whole of the zygomatic arch and is very different in shape from that of any existing armadillo ; its anterior portion, which has a very short contact with the maxillary and an extensive one with the lachrymal, is slender and compressed, but with prominent and somewhat flaring suborbital border; posteriorly it gives off a large, vertical plate of bone, with much thickened and rugose hinder border; this plate extends as far as the posterior edge of the zygomatic process and recalls the process seen in the sloths and glyptodonts, but is placed much farther back and is postorbital rather than suborbital. The dorsal border of the jugal is almost straight, rising gradually to the junction with the lachrymal, while the ventral border has a steep inclination downward and backward. As a whole, the zygomatic arch is relatively longer than in *Tatu* and is much less decurved to form the suborbital border; the jugal makes up a considerably larger share of the arch, extending farther both forward and backward. The arch also curves outward less from the side of the skull, enclosing a longer and narrower temporal fossa, a difference which is increased by the shallower postorbital constriction.

The lachrymal is quite large, though relatively rather less so than in *Tatu*, and less extended posteriorly than in the latter; this posterior extension is slender and apparently solid, while in the modern genus it is so inflated as to have a hollow appearance. The facial surface of the lachrymal is convex but has not such a swollen appearance, nor is it inflected so far into the orbit, as in *Tatu;* it is also less quadrate in shape and ends anteriorly in a point, which is inserted between the frontal and maxillary. The lachrymal foramen is larger and placed more in advance of the orbit than in the existing genus, and behind the foramen is a deep pit, or groove, leading into it, which is wanting in the latter.

Although the frontals are very long and, as in *Tatu*, more than twice as long as the parietals, they form relatively little of the cerebral fossa, the postorbital constriction being but little forward of the coronal suture. This constriction is shallower than in the recent genus, and the expansion of the forehead in front of it is less abrupt. The sagittal area is continued forward upon the frontals, ending in ill-defined temporal ridges. On each side of the sagittal area the posterior part of the frontals is somewhat rugose, elsewhere they have a dense and smooth surface. The forehead is quite different from that of *Tatu*, in which it is vaulted by the great development of the frontal sinuses, while in the fossil the two moderate convexities are separated by a median depression. In one of the skulls (No. 15,565) these convexities are distinct and in the other

(No. 15,566) they are hardly noticeable. Owing to the less inflated form of the forehead, the descent to the rostrum is less abrupt than in the recent genus. Anteriorly, the frontals are quite deeply notched to receive the narrow nasals, and there are long, pointed nasal processes.

The nasals are very elongate, much more so than in *Tatu*, but otherwise of quite similar shape. Narrow posteriorly, they broaden forward, until near the anterior end they cover the whole width of the rostrum and curve farther down upon its sides than in the recent genus. Everywhere they are convex transversely and, for much of their length, they are convex longitudinally also, but anteriorly, owing to the slight upturning of the end of the rostrum, they become somewhat concave in this direction. Dorsally, the nasals project well beyond the premaxillaries, though not so far as in *Tatu*, and their free ends are abruptly truncated and rounded, not bluntly pointed as they are in the latter. The anterior nares are very oblique and have nearly the same shape as in the recent genus, but are rather lower and wider.

The premaxillaries are likewise much longer than in *Tatu*, but do not rise so high upon the sides of the rostrum, of which they form less and the nasals more than in the recent genus. Posteriorly, the premaxillaries are very low and are extensively overlapped by the maxillaries. On the ventral side, the anterior ends of the premaxillaries are curiously similar to what is to be seen in the modern genus: there is a short median process and each bone has two lateral notches, the outer one above and a little in advance of the inner. The palatine processes are narrow, somewhat convex and of almost uniform width throughout, though broadening slightly toward the hinder end; they curve uninterruptedly into the sides of the tubular rostrum. The incisive foramina are elongate and very narrow slits, separated by a slender spine and continued posteriorly by long, shallow grooves.

The maxillaries, like all the bones that enter into the formation of the rostrum, are more elongate than in *Tatu*, while the facial portion is much less inflated, so that externally it projects much less beyond the plane of the teeth and the forward contraction of the rostrum is more gradual. However, this facial region is decidedly inflated and indicates the presence of large antra. The zygomatic process is much shorter than in the existing genus and less expanded vertically, nor does it extend beneath the jugal, with which it has a very short and almost vertical suture. The infraorbital canal is very short and has a much more anterior position than in the recent genus; posteriorly it is continued as an open groove, which is not indicated in the latter. In correlation with the extreme reduction of the teeth, the alveolar process is quite insignificant, but its edentulous portion is extended forward for the whole length of the maxillary, as a delicate though distinct ridge, which sharply demarcates the palatal from the facial surface. The very long palatine processes are widest between the teeth, narrowing somewhat behind them and still more, though very gradually, in front of them. As a whole, the maxillary portion of the palate is slightly concave transversely, but each palatine process is convex in the same direction, which is produced by a deep median groove, with a low ridge along the line of suture. Groove and ridge are much more distinct in one of the specimens than in the other and are not apparent in *Tatu.*

The palatines are quite large and form a considerable extent of the hard palate; their external borders, as in the maxillary region, are thin ridges, which distinguish the lateral from the palatal surface; these ridges converge posteriorly, where the infero-lateral surface of the palatines becomes quite broad, and are continued over upon the pterygoids. Unfortunately, the shape of the posterior nares cannot be clearly made out in either specimen, as the edges are broken; it is apparent, however, that the opening is much longer and narrower and extends farther forward between the palatines than in *Tatu.*

The pterygoids are small bones, mostly concealed from view by the posterior extension of the palatines. Hamular processes and fossæ are absent, but the free border is broadened and thickened, though without the swollen appearance seen in *Tatu;* this border forms an angulation between the ventral and posterior sides, such as does not occur in the modern genus.

The vomer, which is very long and narrow, is not visible in the posterior nares, but extends along the ventral side of the mesethmoid. The latter is very extensively ossified, forming a complete nasal septum, with thickened dorsal and ventral borders. Beneath the cribriform plate it curves downward behind the vomer and unites with the palatines.

The cranial foramina are quite characteristic. High up in the orbit is a long vertical slit, which encloses two separate foramina; of these, the upper one is the optic foramen and the lower one is the foramen lacerum anterius. In the same vertical line with the latter, but well below it, is the foramen rotundum and behind this, on the same horizontal line, is the foramen ovale. A large, irregular opening in front of the tympanic ring probably includes both the eustachian canal and the foramen lacerum medium, while the posterior lacerated foramen is a narrow, slit-like opening behind the petrous portion of the periotic. The glenoid foramen, which is present in *Tatu*, appears to be wanting, but the stylo-mastoid foramen is large and distinct. The condylar foramen has nearly the same position as in the existing genus, but is larger and more conspicuous.

The mandible is extremely peculiar and although it may be not inadequately described as that of *Tatu* in a very exaggerated form, it suggests, at first sight, a likeness to the jaw of an anteater. The horizontal ramus is very long, slender and laterally compressed; its posterior portion has a slightly thickened alveolar border to carry the minute teeth, but, for much the greater portion of its length, it is a narrow, edentulous ridge; the anterior portion tapers forward more gradually than in *Tatu* and ends in a blunter point and the inner surface of the jaw is quite concave. The symphysis is merely a very short contact between the rami at the foremost end of the jaw. The ascending ramus is very low, but very broad antero-posteriorly, and the condyle is placed far behind the teeth, though relatively not so far as in *Tatu*, and is much lower in position than that of the latter; the masseteric fossa is obscurely marked, but large and becoming quite deep beneath the condyle. The anterior border of the ascending ramus is a long, gentle and slightly concave slope, though the coronoid proper is a very low, relatively broad, and recurved hook, entirely different from the high, slender and pointed coronoid of the existing genus. The sigmoid notch is very wide and shallow, in marked contrast to the much narrower and deeper notch of *Tatu*. The condyle is especially peculiar; it is sessile, longitudinal and scroll-shaped, being strongly curved toward the inner side of the jaw, and convex in both directions; it is altogether different from the condyle of the modern genus. The notch between the condyle and angle is much broader and deeper than in the latter, in which the angle is greatly reduced, while in the fossil it is a broad, very thin plate and forms a blunt hook, which projects well behind the condyle. There are two mental foramina, one which opens below the anterior teeth and is large and conspicuous, the other, much smaller, is considerably in advance of this. The inferior dental foramen, which is also large, is placed high up on the inner side of the ascending ramus, with a broad and deep groove leading back from it toward the condyle, which groove is not shown in *Tatu*.

Vertebral Column; Ribs and Sternum.—The cervical vertebræ are of distinctively armadillo-like character and, in particular, resemble those of *Tatu*. In proportion to the size of the head the neck is short, though decidedly longer than in *Dasypus*, stout and heavy. The atlas is shaped much like that of *Tatu*, being short, broad and high and considerably surpassing that of the latter genus in the dorso-ventral diameter. The anterior cotyles are quite narrow and nearly plane transversely, high and concave dorso-ventrally; each is notched near the ventral side and the articular surface is invaded by a sulcus corresponding to that on the occipital condyle. The posterior cotyles are broad, low and quite concave and present obliquely inward. The sides of the atlas are high, flattened, and nearly vertical on their outer faces, meeting the neural and inferior arches almost at right angles, which gives to the bone a characteristically quadrate shape. The neural arch is narrow antero-posteriorly, the cotyles projecting freely in front of and behind it, and is moderately convex on the dorsal side, while the neural spine is a low, but heavy, rugose and quite conspicuous tubercle. The inferior arch is slender and less strongly curved than the neural. The neural canal is somewhat different in shape from that of *Tatu*, being considerably higher than it is wide and divided into nearly equal dorsal and ventral portions by the tubercles for the attachment of the transverse ligament, while in the modern genus the lower portion is the larger of the two. As in the existing genus, the transverse process is greatly reduced, though it is more prominent than in the latter, forming merely a roughened and thickened, imperforate elevation on the posterior part of the dorso-lateral angle. The hinder opening of the vertebrarterial canal is above the inner part of the posterior cotyle and is so covered by the extension of the neural arch as to be concealed, except when the atlas is viewed from behind; the canal passes forward and downward, opening in a conspicuous foramen on the outer side of the bone. The only other foramina are those perforating the neural arch for the passage of the first pair of spinal nerves.

The axis and the two succeeding vertebræ (Plate IV, fig. 1) are completely fused into one long compound bone, though the elements of this may still be distinguished by the sutural lines. In length, the axis makes up nearly one half of the compound mass, exclusive of the odontoid process; the narrowest portion is just behind the cotyles of the axis and thence the mass widens posteriorly, though the widening is due principally to the coalesced transverse processes, the centra remaining of nearly uniform breadth and very much depressed; the mass has a faintly marked median, ventral keel, which is best developed on the axis, and on each side of this keel a number of obscure, oblique lines, converging forward; the centrum of the fourth cervical is made opisthocœlous by the projection of its dorsal and ventral edges, though transversely it is plane. The odontoid process of the axis is slender and of depressed cylindrical, rather than conical form, and on its ventral side is a well-defined, saddle-shaped facet for the inferior arch of the atlas. The cotyles for the latter are low, broad and convex in both directions. In one of the specimens, but not in the other, the dorsal border is notched for the vertebrarterial canal, which opens just behind it and has a slightly more elevated position. The neural canal is quite high and of trihedral shape at the front end of the axis, becoming very low and broad on the fourth cervical, so that the combined neural arches slope downward and backward. The neural spine of the axis and the third cervical are fused together into one large, hatchet-shaped plate, much the greater part of which is contributed by the axis. In shape this compound spine seems to differ somewhat in the two specimens, though in neither is it sufficiently complete to admit of exact comparison. On the fourth cervical the spine is very low, almost obsolete, and is not united with that of the third vertebra. The coalesced zygapophyses make a continuous ridge on each side of the neural arch, enlarged at the points of union between the vertebræ and becoming especially conspicuous on the fourth. The transverse processes also form continuous ridges, ending behind in large, simple, diverging and rod-like projections, but for most of their length they are depressed, shelf-like plates, with thin edges. Thus, the vertebrarterial canal is a long tube, the large and conspicuous anterior opening of which is just behind the cotyle of the axis, while the posterior opening is concealed in the transverse process of the fourth cervical. On the ventral side of the transverse process each vertebra of the compound mass has a foramen opening into the vertebrarterial canal; these foramina seem to be peculiar to the present genus. The spinal nerves make their exits through foramina, which in the axis perforate the pedicles of the neural arch, but elsewhere have an intervertebral position. The fifth cervical is shorter and broader than the fourth and has a much depressed and transversely arched centrum, with concave posterior face which is extended out upon the transverse processes; the pedicles of the neural arch are low and narrow, bringing the zygapophyses of each side very close together; the neural arch is extremely slender, leaving a wide space between itself and the arch of the succeeding vertebra; the transverse process is quite distinctly divided into dorsal and ventral portions and each of these is again divided into anterior and posterior processes, both of which function as additional zygapophyses, articulating with the corresponding processes of the fourth and sixth vertebræ.

In neither specimen is the sixth or seventh cervical preserved.

Of the thoracic vertebræ the first and second and the last five are preserved in connection with one specimen, and the third and fourth with the other, but the nine vertebræ do not form a continuous series and the region must have had at least eleven. In general the thoracic vertebræ resemble those of *Tatu* but they are relatively heavier and there are some differences of detail.

The first thoracic has a broad and depressed centrum, like that of the cervicals in shape, but much more elongate and narrower posteriorly; the neural canal is quite large and the spine very long, broad, laterally compressed and much heavier than that of *Tatu.* At the upper end this spine is coössified with that of the second vertebra, but this is doubtless merely an individual peculiarity. The spine is strongly inclined backward with reference to the long axis of the centrum, but owing to the curvature of the vertebral column in this region it has a nearly erect position. The prezygapophyses, which are of the cervical type, are large, widely separated and placed on the pedicles of the neural arch but little above the level of the centrum, while the postzygapophyses are of the thoracic type and situated on the ventral side of the neural arch. Although they are both broken away, it is evident that the transverse processes were very large and, as in *Tatu*, extended forward, enclosing and almost concealing the last cervical.

The second thoracic is similar to the first, but has a somewhat thicker centrum of more uniform breadth, a much smaller, transversely oval neural canal, prezygapophyses placed on the neural arch, and a higher, somewhat more slender and less steeply inclined spine; the transverse processes are broken on this vertebra also, but enough remains to show that they were less massive than on the first.

The third and fourth thoracics have smaller, but still broad, depressed and opisthocœlous centra, and very small and low neural canal; the neural spines are slender and have a more decided backward inclination than those of the first and second vertebræ; the transverse processes are long, subcylindrical and upturned at the end, where they bear facets for the tubercles of the ribs and indicate that in this region the ribs had long necks. As in *Tatu*, each transverse process is pierced by a foramen which enters the process on the posterior and opens on the ventral side. Minute, incipient metapophyses are present on the fourth vertebra, arising from the front side of the transverse processes, near the base.

The last five thoracic vertebræ gradually take on the characters of the lumbars. The centra, which are remarkably depressed throughout, grow larger posteriorly; the neural spines become shorter, heavier, less strongly inclined backward, more expanded and thickened at the free end; the metapophyses increase rapidly in size, until, on the last vertebra, they are as long as the spine, inclining steeply forward and outward; the transverse processes diminish as the metapophyses increase and are very short on all of these vertebræ. On the tenth and eleventh vertebræ (assuming that eleven is the number of the thoracics) the facet for the tubercle of the rib is brought into immediate juxtaposition to that for the head, which, on the tenth and especially on the eleventh, is very large, prominently projecting and deeply concave; the perforation of the transverse processes continues as far back as the eighth vertebra. The accessory articular processes are already present on the seventh vertebra and they may well have been present on the sixth, as they are in *Tatu*. On the seventh thoracic the postzygapophyses, though still very small, are of the lumbar type and an articular surface is developed on the anapophysis, which is overlapped by a corresponding facet on the metapophysis of the eighth vertebra, and thus there are two pairs of postzygapophyses on the seventh and of prezygapophyses on the eighth. Between the ninth and tenth vetebræ an additional pair of articulations is developed, a posterior one on the ventral side of the anapophysis of the eighth and an anterior one on the dorsal side of the transverse process of the ninth. On the last two thoracics these articular surfaces become larger and more conspicuous.

The last four thoracic vertebræ have deep grooves on the sides of the centra, extending downward and forward from the intervertebral foramina and continued anteriorly upon the ventral side; they become deeper on each succeeding vertebra and are most conspicuous on the last one. Curiously enough, these grooves are asymmetrical, being longer and deeper on the right side than on the left.

The lumbars are four in number and this, with eleven thoracics, would give a total of fifteen trunk-vertebræ, the formula common in *Tatu*, though in that genus the number varies from thirteen to sixteen. The lumbar centra are of moderate size, not greatly exceeding those of the posterior thoracic region, nor do they increase much in size backward, though that of the third is somewhat larger that the others; they are short, broad and depressed and the second has on the ventral side a pair of short, parallel ridges, which are repeated, though very obscurely, on the third and fourth; all the centra, except the fourth, have grooves like those of the last four thoracics, which are best shown on the first. The neural spines are somewhat longer and broader than those of the hindermost thoracic region and are recurved rather than inclined; the free end of each spine is thickened and cleft behind to receive the anterior edge of the succeeding spine; the metapophyses are exceedingly prominent and reach their maximum size on the third vertebra. Each of the lumbars has three pairs of articular processes in front and behind.

The sacrum is much like that of *Tatu*, being very long and composed of nine vertebræ intimately fused together. As a whole and seen from the dorsal side, the sacrum is broad in front, narrows gradually to the end of its contact with the ilium and then again expands, but more suddenly, and attains its greatest breadth at the hinder end. Ventrally, the sacrum is very narrow in front, broadening posteriorly. These alternate contractions and expansions affect chiefly the transverse processes, the centra narrowing regularly from the first to the last, though in the middle region they become extremely thin and plate-like. The neural spines form a low continuous ridge and the neural canal is small. The first sacral vertebra has very prominent metapophyses and two pairs of prezygapophyses, like those of the lumbars, but on the other vertebræ, except the eighth and ninth, the zygapophyses have entirely disappeared. Vertebræ one to three are connected with the ilia, ventrally by pleurapophyses and dorsally by the transverse processes, while the fourth reaches the ilia only by means of the latter. Next follow two vertebræ which are not in contact with the pelvis at all, succeeded by three which unite with the ischia by their greatly developed transverse processes.

Fifteen caudal vertebræ (Plate IV, fig. 2) in apparently uninterrupted succession, are associated with one of the specimens; the series, however, is not complete, for another vertebra which is preserved, is evidently separated from the fifteenth by a gap, and several of the terminal joints are missing. These vertebræ indicate a longer tail than has been observed in any other Santa Cruz armadillo and one which probably was not as long in proportion as that of *Tatu*, but was broader and more depressed. The first caudal has a short, broad, somewhat depressed centrum, with transversely oval and slightly concave faces; on the ventral side are grooves, which start from the hinder border of the transverse processes, converge forward, enclosing between them a raised, triangular area. The neural canal is low, but quite wide, and the neural spine very low, while the zygapophyses are complete, though simple. The transverse processes are remarkably long and straight, extending directly outward from the centrum and slightly widened and thickened at the distal end. These processes, which are much the most striking feature of the vertebra, are very similar to those of the last sacral, and their breadth is nearly equal to the length of the centrum. Passing backward toward the end of the tail, the centra gradually become reduced in diameter, but increase in length; none, however, is more than moderately elongate and they are relatively much shorter than the corresponding bones of *Tatu*. The maximum length is reached in the sixth caudal and is maintained with hardly any change to the fifteenth, and even the much more slender isolated vertebra, which may be taken as the seventeenth, is almost as long as the fifteenth. All the centra have the ventral grooves above described, but they gradually become very obscure; on vertebræ one to four these grooves are continued around the sides of the centra to the hinder opening of the neural canal. Small hæmapophyses for the attachment of chevron-bones are present on all the caudals, except the first, and perhaps on that one also, but, if so, they are very feebly developed. Zygapophyses cease quite abruptly on the eighth vertebra, which has long anterior, but no posterior processes. Metapophyses, on the other hand, persist on all of the caudals, diminishing posteriorly. The neural canal diminishes rapidly, but remains, as a fine, hair-like tube, as far back as the fifteenth vertebra, on which it is, for most of its length, a very narrow groove; no trace of the canal appears on the ?seventeenth. The neural arch is high, especially behind, where it carries the postzygapophyses, and even after the latter have disappeared, the arch continues as a prominent ridge, with a wedge-shaped top, and is recognizable even on the ? seventeenth caudal. Distinct neural spines occur only on the first and second vertebræ. The transverse processes diminish gradually in length throughout the series, but are distinct even on the ? seventeenth. Vertebræ one to four have similar transverse processes, except that on the fourth the ends are vertically expanded and decurved in a way that does not occur in any other vertebra. At the fifth caudal a comparatively sudden change occurs, the transverse processes becoming broader and curving forward, and at the distal end the breadth of the process exceeds the length of the centrum, an arrangement which continues to the twelfth. These broad, wing-like processes are very characteristic of the present genus and are quite different from those in the corresponding region of *Tatu*, in which the breadth of the processes is much less than the length of the centrum, and consequently the intervals between the successive processes are much greater than in the fossil.

Seven chevron-bones are associated with the same individual, none of them, unfortunately, in position; they are triangular in shape and perforated by a canal for the caudal artery and vein. Anteriorly, the chevron-bones are narrow in the fore-and-aft dimension and, when viewed from the end, have the shape of a nearly equilateral triangle, with a large perforation; posteriorly, they become shorter dorso-ventrally, broader and more canoe-shaped, while the canal is reduced.

Of ribs, two are preserved. The first rib is of the usual armadillo pattern; it is short, but extremely broad and plate-like, with concave inner, straight outer and convex ventral border. The other ribs are relatively broad and in shape resemble those of *Dasypus*, rather than those of *Tatu*.

Of the sternum, the posterior segment, or xiphisternum, has been recovered; it is quite broad in front, tapering posteriorly, and its anterior end has two facets for the sternal ribs, separated by a distinct notch.

Appendicular Skeleton. — The scapula (Plate IV, fig. 3), is quite peculiar and differs from that of any other Santa Cruz genus, as well as from that of any existing armadillo with which I have been able to compare it, being remarkably small, both in height and in the breadth of the dorsal part. On the whole, the nearest resemblance is with the shoulder-blade of *Tatu*, though there are many differences. The neck is broad, more so than in *Tatu*, and there is no coraco-scapular notch, a marked distinction from *Dasypus*; the coracoid border is concave for about half its length and then becomes convex, curving gradually into the suprascapular border, while in both of the last-named genera the two borders meet at an angle. So far as it is preserved, the suprascapular border is regularly arched, but, as the postero-superior angle of the blade is broken away, I cannot determine whether or not it had the remarkable prolongation seen in most recent armadillos. It may be inferred, however, that the angle was much less produced in the fossil, because the glenoid border is nearly straight, not concave; this border is thickened and forms a ridge, which is roughly parallel with the spine and, while rather more conspicuous than in *Tatu*, is much less so than in most other modern genera. The spine is placed slightly behind the middle of the blade, making the prescapular fossa a little larger than the postscapular; it is high and very strongly recurved, so as to have a deeply concave posterior side. The acromion is broad, thin and curved forward; so far as it is preserved, it resembles that of *Tatu*, except in having a smaller metacromion, but it is so broken that its length is indeterminable. The glenoid cavity is shallow, narrow transversely, but quite elongate, and the coracoid is small.

The humerus (Plate IV, fig. 4) exhibits some peculiarities; the head is elongate, narrow and quite strongly convex in both directions, projecting somewhat behind the plane of the shaft; the external tuberosity, though broken, was evidently very large, while the internal one is greatly reduced, as in *Tatu*, bringing the bicipital groove, which is narrower than in the latter genus, to the inner angle of the proximal end. The deltoid area, though larger and more prominent than in *Tatu* or *Dasypus*, is not so well developed as in the other Santa Cruz genera; it is broad and rugose with prominent borders, which give a concave shape to the sides of the shaft. The latter is short and heavy and of the usual shape, compressed and thick proximally, broad and thin distally; the supinator ridge is very prominent, adding much to the breadth of the distal part and its outer border passes upward into a raised line, which extends on the hinder face of the shaft to the inner tuberosity; the internal epicondyle is very large and massive and the foramen is also large. The trochlea is quite different from that of *Tatu* or *Dasypus*, being broad and low, but increasing in vertical diameter towards the inner side and ending on that side in an unusually prominent sharp-edged flange, which is highly characteristic; the tuberosity for the head of the radius is much more convex and distinct than in the other Santa Cruz genera and shifted nearer to the median line.

The anconeal fossa is deeper than in the other contemporary armadillos, while the supratrochlear fossa is of only moderate depth.

No portion of the forearm or manus has been found, which is especially unfortunate, as the humeral trochlea indicates a somewhat peculiar character of the ulna and radius.

The pelvis is very much like that of *Tatu*. The ilium is long, slender, and trihedral, with strongly everted anterior end; the acetabular border is a thin ridge, external in position, which makes the gluteal surface present dorsally and the iliac surface ventrally. As in the modern genus, the anterior end of the ilium is not expanded into a plate, but is much thickened and club-like, with very rugose crista; the suprailiac border is very long and is extended farther back along the sacrum than in *Tatu*, making the ischial border much more concave, and the peduncle of the ilium is relatively shorter and heavier and the sacro-sciatic foramen is consequently smaller. The pubic border is broad, rounded and ill-defined; near the acetabulum it supports an ilio-pectineal process, which is remarkably large and rugose, though not very prominent. In no other known Santa Cruz armadillo is such a large process to be found. The acetabulum is large and presents downward almost as much as outward; the dorsal border is given a notched appearance by the prominence of the anterior end and the articular surface is deeply invaded by the sulcus for the round ligament. The ischium is short, but broad and plate-like, and has a heavier appearance than in *Tatu*, the descending branch being much broader than in the latter. In the specimen before us the ischium is com-

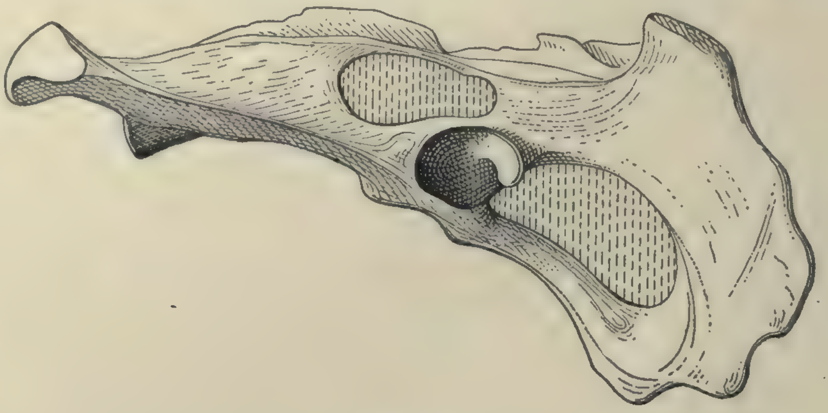

Fig. 6.

Pelvis of *Stegotherium tesselatum*, left side; × $\frac{2}{3}$.

pletely fused with the transverse processes of the last four sacral vertebræ, but with the posterior angle rising well above the sacrum and thickened to support the carapace. As the limits between the pubis and ischium cannot be distinguished, it is uncertain whether the latter enters into the symphysis or not. The pubis is quite slender, though decidedly stouter than in *Tatu* and forms a longer symphysis than in the latter; the obturator foramen is relatively smaller than in the recent genus and of a more regularly oval shape.

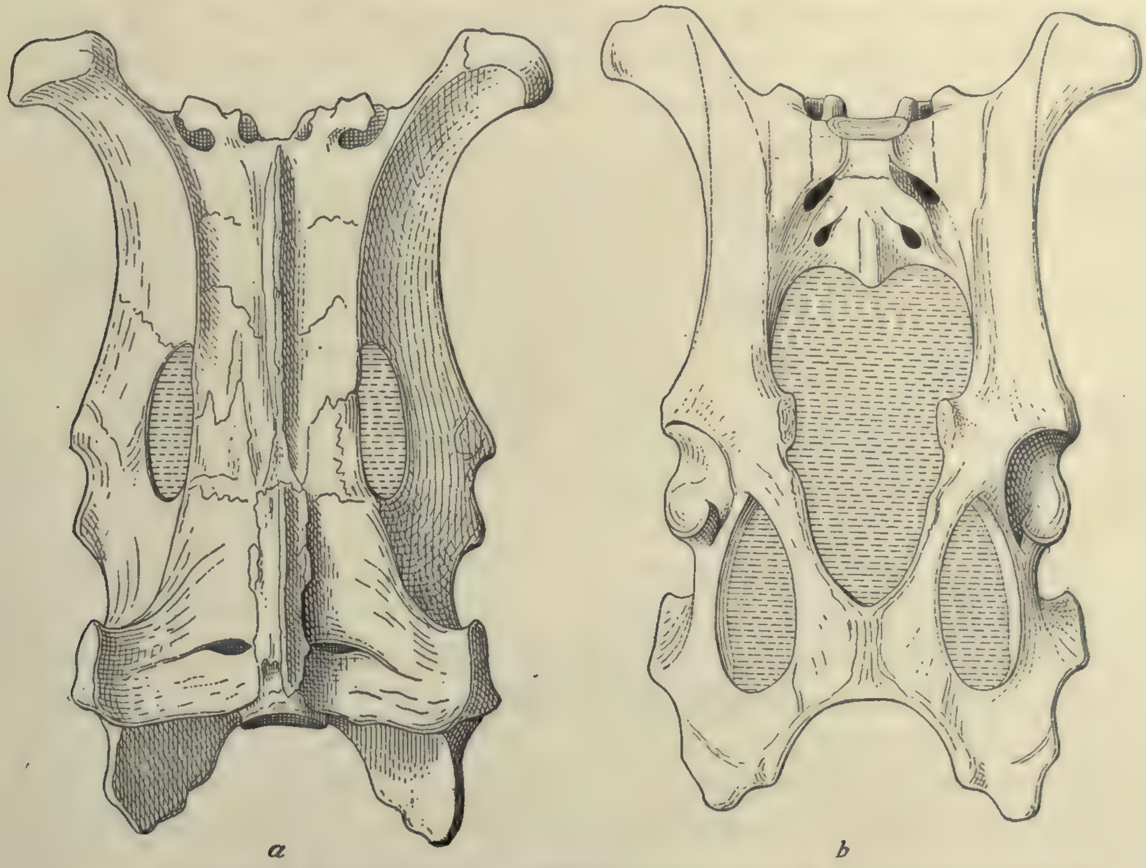

Fig. 7.
Pelvis of *Stegotherium tesselatum*, × $\frac{2}{3}$. *a*, dorsal view; *b*, ventral view.

The femur (Plate IV, fig. 5) resembles that of *Tatu;* the hemispherical head is set upon a broad and thick, but distinct neck and presents upward more than inward; the notch between head and great trochanter is much deeper than in *Dasypus*, broader and more V-shaped than in *Tatu;* the pit for the round ligament is a large, shallow, triangular depression on the posterior aspect of the head, emarginating the articular surface and not enclosed by it. The great trochanter is high and thick, rising well above the level of the head, though hardly so large proportionately as in *Tatu;* the digital fossa, though better defined than in the latter, or in *Dasypus*, is extremely small and shallow. The second trochanter is a long, prominent, rugose ridge, which is more widely separated from the head and is longer proximo-distally, but much less prominent than in *Dasypus*. The third trochanter has about the same relative position as in *Tatu*, but is not so prominent, nor so much curved forward. The shaft is very broad and much more compressed antero-posteriorly than in either of the last named modern genera; it has a very decided outward curvature, which would be regular, were it not for the second and third trochanters; aside from the former, the inner border is quite regularly concave, while below the third trochanter on the outer border is a sharp ridge, which ends in the tuberosity. The anterior face of the shaft is much less convex than in *Tatu* and the posterior face is nearly flat. The rotular groove is broad and shallow, decidedly more so than in *Dasypus* or *Tatu*, being almost plane transversely; there is no suprapatellar fossa. The condyles, which are widely separated, are small and of unequal size, the internal one considerably larger than the external.

As in the armadillos generally, the tibia and fibula (Plate IV, fig. 6) are coössified at both ends. The tibia is of nearly the same length as the femur exclusive of the great trochanter; the proximal facets are of nearly equal size, but of different shape; the external facet is convex and the internal is at a lower level and concave; there is no tibial spine other than a slight elevation of the mesial border of the inner condyle. The cnemial process is long and prominent and is continued into a ridge which reaches to the distal end, as in *Tatu*. The shaft is strongly arched toward the inner side and is moderately curved forward; its external border is a ridge distinct from that which fuses with the fibula. On the postero-internal angle of the distal end is a deep tendinal sulcus between the internal malleolus and the posterior tongue-like process. The astragalar surface is broad, but much compressed antero-posteriorly, and is divided into two facets, of which the external one is deeper and more concave; the intercondylar ridge ends posteriorly in a tongue-like process, which is much more prominent than in *Tatu*.

The fibula is laterally compressed and plate-like; the distal end, which forms a heavy external malleolus, bears a small but distinct facet for the calcaneum; the sulcus for the peroneal tendon is very obscure.

The hind-foot (Plate IV, fig. 7), which belongs to No. 15,565, differs in many respects from any other pes that has been found in the Santa Cruz beds.

The astragalus has the short, broad, depressed form usual in the armadillos, but the trochlea is more deeply grooved than in the other Santa Cruz genera and is divided into two very unequal condyles, of which the external one is much the broader, while the internal is higher and more convex; the fibular facet is somewhat everted at the plantar edge, and the external calcaneal facet is very large and concave and much produced externally, while the sustentacular facet is small, of elongate, subquadrate shape and entirely isolated from the other. The neck is short, broad and depressed and has a shallow depression on the dorsal side; the head is transversely convex, very low in the dorso-plantar dimension.

The calcaneum is conspicuously different from that of any other known Santa Cruz armadillo; among existing genera, it most resembles that of *Tatu*. The tuber is very elongate, longer than in the latter, and compressed, but deep in the dorso-plantar diameter, with no expansion at the free end; the dorsal border is nearly straight, the ventral somewhat sinuous; at the proximal end is a very short, but distinct, tendinal sulcus. The external astragalar facet is short, but very broad transversely, projecting out beyond the side of the tuber, and its outer end bears a small facet for the fibula, which is continuous with the fibular facet on the astragalus, when the two bones are in position. The sustentaculum is very prominent, but narrow and pointed and bears a small, isolated, subcircular facet for the astragalus. The cuboid facet is small and but slightly concave, narrowing toward the plantar side; external to it is a large, rugose tubercle.

The navicular is broad, short and thin and is not extended up on the inner side of the astragalar head, as it is in most armadillos. On the plantar side is a prominent, hook-like process and on the distal end are three well-distinguished facets for the cuneiforms; the cuboid surface is a narrow band on the plantar side.

The entocuneiform is shaped much as in *Dasypus*, being relatively large, but thin and scale-like; its facet for the navicular is concave, oblique and somewhat warped; that for metatarsal I is saddle-shaped.

The mesocuneiform is small, but not so much reduced as in *Dasypus* or *Tatu*, and its principal diameter is the dorso-plantar; the exposed dorsal surface is nearly square and both proximal and distal ends are concave.

The ectocuneiform is relatively larger than in *Dasypus*, though hardly so broad as in *Tatu;* on the dorsal surface the transverse diameter exceeds the proximo-distal, but the bone contracts much toward the plantar side; distally, it expands beyond the head of metatarsal III and has a considerable contact with metatarsal IV.

The cuboid is quite small, but little exceeding the ectocuneiform in size and of irregularly pyramidal shape. On the outer side is the calcaneal facet, which is external rather than proximal, almost plane and very oblique, sloping upward and inward and nearly meeting the large navicular facet; the distal end is principally occupied by the large facet for metatarsal IV, that for metatarsal V being very small.

As in the armadillos generally, the metatarsus consists of five members, the median three much larger than the laterals (I and V) which are greatly reduced in length, though not in breadth or thickness. In shape and proportions these bones most nearly resemble those of *Tatu*, though they are more massive.

Metatarsal I is extremely short and heavy, no longer than a phalanx, to which it bears considerable resemblance; the proximal end has a very large, saddle-shaped surface for the entocuneiform and the distal end an extremely low trochlea, with very short, though prominent, plantar keel.

Metatarsal II is more than twice as long as metatarsal I and very heavy; the proximal end is narrow, bears a very oblique and nearly plane surface for the mesocuneiform and rises well above the level of metatarsal III, so as to have an extensive lateral contact with the ectocuneiform; the shaft is broad and depressed, of somewhat irregular shape, widening to the distal end, which has a very low trochlea, with a median depression on the dorsal side and a prominent keel on the plantar.

Metatarsal III is the longest of the series and is narrower and thicker than metatarsal II; the proximal end is slightly broader and considerably thicker than the shaft, which is of nearly uniform width, though broadening somewhat at the distal end, and is of trihedral shape, not compressed planto-dorsally; the trochlea is well developed, higher and reflected farther upon the dorsal side than in any other member of the series.

Metatarsal IV is longer than metatarsal II, but considerably shorter than metatarsal III; it has a broad, very oblique proximal end, which articulates with both ectocuneiform and cuboid, as in *Tatu;* proximally the shaft is narrow, but thick, but it becomes narrower and more depressed distally, with nearly straight tibial, and deeply concave fibular border; the trochlea is very oblique and almost entirely distal, but the carina is prominent, nevertheless.

Metatarsal V is much reduced, and is a little longer, though rather more slender, than metatarsal I; the head bears a very small proximal facet for the cuboid and a much larger lateral one for metatarsal IV, while on the fibular side is a prominent tubercle for the lateral ligament; the shaft is short, broad and depressed and the trochlea is curiously modified, being oblique and saddle-shaped, while the carina is reduced to a mere tubercle.

Phalanges are preserved only in connection with digits I, II and III. Of digit I the proximal phalanx is relatively long and narrow, especially at the distal end, and much depressed. In digit II this phalanx is short, depressed and very broad; the proximal end is deeply notched on the plantar side for the metatarsal carina, while the distal trochlea has a short dorso-plantar diameter and a deep median notch, which is especially conspicuous on the dorsal side. In digit III this phalanx is a little longer and broader, but otherwise similar.

The second phalanx of digit II is longer, narrower and thicker than the proximal one, and narrows more distally; the proximal trochlea is divided into two entirely distinct facets and the dorsal border forms a thick, blunt median beak, which fits into the distal notch of the proximal phalanx. In digit III the second phalanx is of similar shape, but somewhat larger.

No other known Santa Cruz genus has ungual phalanges at all resembling those of *Stegotherium*. In digit II the ungual is shaped much as in *Tatu*, but is somewhat larger and heavier, more convex on the dorsal side and more decurved. In digit III this phalanx is remarkably large and stout, far larger proportionately than in *Tatu;* it is broad and thick at the proximal end, tapering to a very sharp and strongly decurved point at the distal end; the lateral edges are very sharp, the dorsal side strongly convex and the plantar concave, and the subungual process is a prominent rugose, triangular area, perforated by two foramina.

Restoration (Plate II).—As a whole, the aspect of the skeleton immediately recalls that of *Tatu*, although with the increased stature are associated a greater thickness and massiveness of the bones. The most striking difference between the two genera is in the skull, which appears to be much more elongate in the fossil, but is not, when compared with the vertebræ and limb-bones. This appearance of elongation is due to the slenderness of the rostrum and mandible and to the absence of that inflation of the whole frontal region, which is so characteristic of the modern genus. Other differences are the well-defined temporal fossæ and the suborbital plate descending from the jugal in *Stegotherium.* In the vertebræ of the neck and trunk there are no differences that call for particular comment, but the tail of the fossil was almost certainly considerably shorter. At all events, the individual caudal vertebræ are shorter and much heavier, while the transverse processes are much broader, leaving less space between those of the successive vertebræ. It is in the dorsal, rather than in the side view, that the difference between the two genera in the character of the caudals is most apparent. The scapula of *Stegotherium* is smaller, more rounded and of a different shape from that of *Tatu*, and the pelvis is distinctly heavier, with smaller sacro-sciatic and obturator foramina. The limbs and feet, so far as they are known in the fossil, are very much alike in both genera although they are distinctly heavier in the former.

Systematic Position. — The systematic position of *Stegotherium* seems to be sufficiently clear; it is a representative of an entirely extinct line, which has no descendants in the modern fauna. The extreme reduction of the teeth, the elongation of the rostrum, the length and slenderness of the mandible (which has a superficial likeness to that of the anteaters), are all specializations which find no parallel among the existing armadillos. The carapace, as a whole, and the form and markings of the individual scutes are also quite unlike those of any living member of the order. On the other hand, in all parts of the skull and skeleton there is an unmistakable resemblance to *Tatu;* the correspondences between the two genera are so many and so close, that they cannot be regarded as accidental, or due to a parallel development. Evidently, *Stegotherium* is a side-branch of the same stock as that which has terminated in *Tatu* and, doubtless, a common ancestor of the two lines will eventually be discovered in some of the formations which are more ancient than the Santa Cruz beds.

Ameghino has constructed a special family for the reception of this genus ('94*a*, 179), but though this course may eventually be necessary, it does not appear to be called for, so far as our present knowledge extends. It is true that the significance attached to the family is very different among various systematic writers, but palæontological usage is approximating to the view that the family should be regarded as a closely connected phylogenetic series, together with such short side-branches as did not themselves become extensively ramified. On this view, *Stegotherium* should be included among the *Tatuidæ*, to which it is evidently allied and of which it forms a side-branch that never at any one period became greatly varied or widely ramified into numerous genera. In the Santa Cruz beds representatives of this genus are comparatively rare and, so far as is yet known, the entire series became extinct at the close of that epoch, for no member of it has been found in any of the subsequent formations.

Stegotherium tesselatum Ameghino.

(Plates I–IV.)

Stegotherium tesselatum Amegh.; Enumeracion sistematica, etc., p. 25.
Peltephilus strepens Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 68.

This species was established upon isolated scutes of the carapace, which agree so well with those of the two specimens in the Princeton collection that I have no hesitation in assigning them to it. The preceding account of the osteology of the genus is drawn from those two individuals and it only remains to give the principal measurements.

Measurements.

	No. 15,515.	*No. 15,566.*
Skull, length on median basal line	.120	———
" " occipital condyle to end of rostrum	.139	———
Cranium, length to anterior border of orbit	.049	.050
Face, length	.090	———
Occiput, height	.036	.036
" width at base	.040	? .042
Skull, width over lachrymals	.038	? .042
Rostrum, width at hinder end of nasals	.021	? .023
" " " anterior end	.0105	———
Mandible, length	? .109	.107
" " angle to last tooth	? .047	.0455
" " of edentulous part	.048	.046
" " height of coronoid process	.016	.014
" " " " condyle	.0145	———
" " depth of horizontal ramus at last tooth	.006	.006
" " thickness of ramus at last tooth	.0035	.003
Upper dental series, length	.0115	.0105
Lower " " "	.015	.014

MEASUREMENTS.

	No. 15,515.	*No. 15,566.*
Atlas, transverse breadth	——	.033
" width of neural arch	——	.011
" " " inferior arch	——	.005
Axis, width over anterior cotyles	.026	.026

	No. 15,565.	*No. 15,566.*
Cervical mass, length (exclusive of odontoid)	.0375	.038
Odontoid process, length	.009	.010
Fifth cervical, length	.008	——
" " width	.026	——
First thoracic, length of centrum	——	.011
" " width of anterior face	——	.021
Second " length of centrum	——	.011
" " width of anterior face	——	.016
Third " length of centrum	.011	
" " width of anterior face	.017	
Fourth " length of centrum	.010	
" " width of anterior face	.014	

The remaining measurements of the vertebræ and limb-bones are all taken from one specimen, No. 15,566.

Eighth thoracic, length of centrum	.012
" " width of posterior face	.016
Eleventh " length of centrum	.012
" " width of posterior face	.017
First lumbar, length of centrum	.0125
" " width of posterior face	.0175
Second " length of centrum	.0135
" " width of anterior face	.017
Third " length of centrum	.015
" " width of anterior face	.0175
Fourth " length of centrum	.013
" " width of anterior face	.0175
" " " " posterior face	.0185
Sacrum, length	.114
" width at first vertebra, dorsally	.030
" " " " " ventrally	.025
Sacrum, width at last vertebra over transverse processes	.066
First caudal, length of centrum	.014
First caudal, width over transverse processes	.070
Fourth caudal, length of centrum	.016
Fourth caudal, width over transverse processes	.052
Seventh caudal, length of centrum	.018
Seventh caudal, width over transverse processes	.035
Tenth caudal, length of centrum	.018
Tenth caudal, width over transverse processes	.0245
Thirteenth caudal, length of centrum	.017
Thirteenth caudal, width over transverse processes	.019
Fifteenth caudal, length of centrum	.016
Fifteenth caudal, width over transverse processes	.016
? Seventeenth caudal, length of centrum	.015
? Seventeenth caudal, width over transverse processes	.0115
First rib, length	?.043
" " width of distal end	.035
Scapula, length	.076
" width of neck	.020

Scapula, antero-posterior diameter of glenoid cavity	.017
Scapula, transverse diameter of glenoid cavity	.011
Humerus, length	.083
“ width of proximal end	.022
“ “ “ distal end	.024
Pelvis, length	.157
“ width over iliac cristæ	.105
“ “ of anterior opening	.040
“ “ “ posterior opening	.057
Ilium, length	.088
“ breadth of anterior expansion	.023
Ischium, length	.069

Pubis, length	.058
Symphysis, length	.017
Acetabulum, antero-posterior diameter	.022
Femur, length from head	.107
“ “ “ great trochanter	.114
“ width of proximal end	.037
“ “ “ distal end	.032
Tibia, length	.105
“ width of proximal end	.030
“ “ “ distal end	.022
Fibula, length	.102
“ thickness of proximal end	.028
“ width of distal end	.010

The following measurements of the pes are from No. 15,565.

Astragalus, length	.020
“ width of trochlea	.016
“ “ “ neck	.011
Calcaneum, length	.0375
“ “ of tuber	.025
Metatarsal I, length	.011
“ “ width of proximal end	.0075
“ “ “ “ distal end	.0065
Metatarsal II, length	.021
“ “ width of proximal end	.007
“ “ “ “ distal end	.009
Metatarsal III, length	.026
“ “ width of proximal end	.007
“ “ “ “ distal end	.009
Metatarsal IV, length	.022
“ “ width of proximal end	.0085
“ “ “ “ distal end	.008
Metatarsal V, length	.0125
“ “ width of proximal end	.004
“ “ “ “ distal end	.007

First phalanx, digit I, length	.011
First phalanx, digit I, width of proximal end	.008
First phalanx, digit II, length	.011
First phalanx, digit II, width of proximal end	.010
First phalanx, digit II, width of distal end	.008
Second phalanx, digit II, length	.012
Ungual phalanx, digit II, length	.014
First phalanx, digit III, length	.0105
First phalanx, digit III, width of proximal end	.011
Second phalanx, digit III, length	.012
Second phalanx, digit III, width of proximal end	.0095
Ungual phalanx, digit III, length	.020
Digit II, length	.050
“ III, “	.062

Specimen No. 15,566 was found by Mr. Hatcher at Coy Inlet; the other individual was presented to the expedition by Mr. Felton, of Killik Aike.

STEGOTHERIUM SIMPLEX Ameghino.

Scotæops simplex Ameghino, Enum. sistem., 1887, p. 24.

Of this species very little is known and it may perhaps be identical with the preceding one, but, for the present, it seems advisable to keep them apart. The type and only known specimen, which belongs to the Museum of La Plata, consists of a fragment of the right half of the mandible, including the posterior part of the horizontal and the anterior part of the ascending ramus; it has two well-marked alveoli and, apparently, the remnants of several others that had partly closed after the loss of the teeth. Uncharacteristic as this fragment is, there seems to be sufficient reason for referring it to the present genus; its specific distinctness is indicated by the greater depth and thickness of the horizontal ramus and by the thicker anterior border of the ascending ramus.

Mandible, depth at last tooth, .0086.
" thickness at last tooth, .004.

DASYPODIDÆ.

As in the recent fauna, this family was in Santa Cruz times much the most abundant in numbers and varied in genera and species of all the contemporary armadillos. It varies greatly in the size of its members, from the exceedingly small *Prozaëdius* to the very large and robust species of *Proeutatus*.

PROEUTATUS Ameghino.

(Plates VII–XV.)

Eutatus Ameghino, *non* Gervais; Enumeracion Sistematica, etc., 1887, p. 25.
Proeutatus Ameghino; Revista Argentina de Historia Natural, 1891, p. 327.
Thoracotherium Mercerat; Revista del Museo de La Plata; Tom. II, 1891, p. 42.
Eutatus, Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 62.

This is the most abundant and the most varied of the Santa Cruz armadillos and is represented in the collection by several remarkably well preserved specimens, which permit a very full account of the skeleton to be given, the only parts concerning which information is imperfect being the carapace and the tail. This lack of fairly complete carapaces is especially unfortunate, for most of the species have been established upon the differences in the sculptural pattern of the scutes, and this varies so much in different parts of the same carapace that isolated plates are often very deceptive.

Exoskeleton. — The head-shield is still incompletely known and the only specimen of it that I have seen consists of a number of plates attached to the skull of *P. robustus;* these are of irregularly polygonal shape, with more or less rounded angles, of very different sizes, and with coarsely pitted surface.

The carapace, as in other Santa Cruz armadillos, forms no scapular buckler and the pelvic shield appears to be relatively small; one specimen displays eight rows of fixed plates in this buckler, but almost certainly lacks one or more of the hindermost bands. All the scutes are thick and massive, and are conspicuously sculptured, in patterns that differ more or less strongly in the different species. In the movable bands the scutes of the anterior and median regions are long and narrow, and somewhat more than one third of each is overlapped by the preceding plate; posteriorly and on the sides of the carapace the plates become considerably broader in proportion to their length. The marginal plates are shaped much as in the movable bands of *Dasypus*, with curved free borders and overlapping each other but little; they are not sculptured, but quite smooth and finely punctate. The fixed plates of the pelvic buckler are very thick, shorter and broader than the movable scutes and with a sculptural pattern which is a modification of that seen in the latter.

Dentition. — In all of the species the dental formula is $\frac{9}{10}$. In at least two of the species and probably in all, $\underline{1}$ is implanted in the premaxillary; $\underline{2}$ is larger and laterally compressed and has a bevelled masticating surface; $\underline{3}$ is still larger and of similar shape. All the succeeding upper teeth have flat grinding surfaces and are, except the last one, more or less distinctly bilobate. The teeth of the two sides converge anteriorly to $\underline{4}$ and then become parallel. In the lower jaw the first four teeth are small and compressed, $\overline{5}$ is much larger, but of similar shape, while the posterior five teeth have a rudely triangular grinding surface. In both jaws the large posterior teeth have the dentine very clearly arranged in three layers; the periphery of the tooth is formed by a dense, smooth, enamel-like layer and a similar tissue forms the core; while between the two is a layer of softer dentine, which wears away more rapidly, leaving the harder parts in relief. A similar arrangement is found in the Pampean genus *Eutatus*. Still another pecularity of these teeth, also shared by those of the latter is the exceedingly low crown, the exposed portion being lower than in any other Santa Cruz armadillo.

The description of the skeleton can most conveniently be given in connection with the various species.

Relationships. — *Proeutatus* is evidently closely allied to the Pampean genus *Eutatus*, though there is some difficulty in regarding any known species of the former as ancestral to the latter. The Pampean genus is much larger in size; its carapace consists of more numerous transverse bands, 33 instead of 24 or 25; the pelvic buckler is relatively larger and is made up of 12 or 13 bands, while in the Santa Cruz genus the number can hardly exceed 10; the skull is quite different in appearance, having more resemblance to that of *Tatu*, and the phalanges are reduced by co-ossification to two in each digit. Among existing armadillos *Proeutatus* most resembles the *Dasypodidæ* in the restricted sense of that term. Though the feet show no tendency to the peculiar type seen in *Cabassous* and *Priodontes*, the trunk and limbs have many resemblances to those genera.

PROEUTATUS ROBUSTUS sp. nov.

(Plates VIII–XI, XIII, Figs. 4, 5; XIV, Figs. 1–4.)

This species is selected as the standard of comparison, because more complete skeletons of single individuals are known from it than from any other species of the genus. The type-specimen, collected by Mr. Hatcher at Corriken Aike (No. 15,214), consists of a skeleton lacking much of the carapace, the anterior end of the rostrum, the pelvis, tail and hind-limbs. A second individual (No. 15,957) which retains most of the carapace, many vertebræ, the pelvis, fore- and hind-limbs, was found by Mr. Peterson at the same locality. Other individuals, much less complete, are probably referable to the same species.

The species is characterized by its larger size and notably heavier proportions than in those previously described, and by a somewhat different pattern of sculpture in the carapace. Almost every part of the skeleton shows characteristic features, to which attention will be called in the following description.

Exoskeleton. — The head-shield (Plates IX; XIII, fig. 4) is made up of irregularly polygonal plates, with rounded angles; larger and smaller plates are arranged with very little indication of a definite plan, except that in the supraorbital region many of the scutes are larger than elsewhere; the only sculpturing is a coarse pitting.

The carapace in No. 15,957 (Plate VIII) consists of at least fifteen or sixteen transverse movable bands and of eight fixed rows in the pelvic buckler, though the latter is evidently not complete. The markings of the scutes differ in the different regions of the carapace; along the middle dorsal region, for most, if not all of its length, the anterior exposed part of each scute is quite smooth, except for a number of small, irregularly placed pits, but much the greater portions of the exposed part is rather coarsely punctate and has three longitudinal ridges, of which the median is the narrowest and most convex, while each of the laterals is interrupted near the middle of its course by a large and conspicuous piliferous pit.

On the sides of the carapace the pattern is like that of *P. œnophorus* and *P. lagena*, the only difference from the latter two species being that in them the bottle-shaped figure is, in the hinder portion of the movable region, carried all across the carapace from side to side. The marginal plates of the movable bands resemble those of *Dasypus*, except that they are not so pointed behind. In the anterior part of the carapace they are very small, but become much larger posteriorly.

The pelvic buckler has been lost from the type and in the other specimen it has been so much abraded that the markings are obscure, but the pattern does not seem to be materially different from that in *P. lagena*, and *P. œnophorus*.

Dentition (Plate XIII, fig. 5).—The teeth are not in a very satisfactory state of preservation. As the anterior part of the rostrum is missing, the dental formula is not determinable, and even in the portion of the jaws which is preserved the small anterior teeth are badly broken. Assuming that the formula is the one usual in this genus, it may be observed that $^{\underline{5}}$ and $^{\underline{6}}$ are more quadrate and less pear-shaped than in the allied species, and are much more distinctly divided into two lobes by a vertical, internal groove, while $^{\underline{6}}$ is relatively larger.

Upper dentition, length $^{\underline{4-9}}$ .032. Lower dentition, length $_{\overline{5-10}}$ .033.

Skull (Plate XIII, figs. 4, 5).—The skull is large and massive, with full, rounded cranium, the base of which is raised high above the level of the teeth. The occiput is large, both broad and high, somewhat convex transversely and without any prominence for the vermis of the cerebellum; near the dorsal summit is a large and deep fossa. The occipital crest is very prominent and quite thick. The basioccipital is broad behind, narrowing forward; its hinder end is broadly, but not very deeply notched by the foramen magnum, which is very large. The condyles are of semicylindrical shape, sessile and transverse. No paroccipital processes are present, but the mastoid portion of the periotic, which is quite extensively exposed on the surface, ends in a short, heavy mastoid process. The tympanic, which was very loosely attached, is a small, incomplete ring of bone, with large, irregular external meatus. The parietals are relatively short and hardly form so much of the cranial roof as in *Dasypus* and they carry a low, but very distinct sagittal crest, which is much better defined than in the allied species. On each side of the crest is a narrow and smooth sagittal area, thus producing a characteristic triple appearance. This area is quite broad at the junction with the occipital crest, narrows rapidly and then broadens again gradually to the coronal suture. Along the squamosal sutures the parietals are perforated by a number of conspicuous venous foramina and their surface is generally rough.

The squamosal is long, but low, forming relatively little of the cranial wall; the portion ventral to the glenoid cavity and external to the tympanic has an inflated appearance, as though it were involved in the formation of the auditory bulla. The glenoid cavity proper is a slightly convex surface, most of which is placed upon the ventral side of the zygomatic process, but internal to this is a deep, longitudinal groove, ending posteriorly in a deep fossa, at the bottom of which the glenoid foramen opens; there is no definite postglenoid process, the fossa abutting against the posttympanic process. The zygomatic process has much the same shape as in *Dasypus*, but its dorsal surface is somewhat more concave and it does not extend so far over the jugal. The latter is rather short; its posterior half is laterally compressed and slender, while the anterior half is expanded into a great vertical plate, which together with the zygomatic process of the maxillary, forms a large, anteriorly presenting, suborbital process, like that of the glyptodonts on a much smaller scale. As a whole, the zygomatic arch pursues a course like that of *Dasypus*, curving downward and forward.

The lachrymal has a fairly large facial portion, which contracts to a point anteriorly; the foramen is small and placed within the rim of the orbit. The frontals are large and together have an hour-glass shape, with deep postorbital constriction, in front of which they expand more widely than in *Dasypus*, forming more concave orbits. The forehead is broad and lozenge-shaped, with two prominences formed by the frontal sinuses and a broad depression between them. Nasals and premaxillaries have been lost.

The maxillary is very elongate and high in front of the orbit, where the lateral surface curves into the dorsal without any such angulation as occurs in *Dasypus;* the infraorbital foramen is more elevated than in the latter. The palatine processes are long and narrow, widening somewhat posteriorly and are nearly plane. The palatines are quite large and form a considerable part of the hard palate, but they are not continued so far behind the teeth as in the recent genus; in this region the palate is quite concave. The posterior nares are large, emarginating the palate more deeply than in *Dasypus*, and have a lanceolate anterior border.

The mandible has an elongate horizontal ramus, of no great vertical depth, but thick and rounded externally; the symphysis is lost, but from what remains, it would seem that this region was laterally compressed and but little tapered. The ascending ramus has a more posterior position than in *Dasypus*, not concealing the last tooth, as it does in the latter. This ramus is high, but not very broad and its ventral border is raised well above that of the horizontal ramus, producing a marked constriction at the junction of the two. No angular process is formed and the angle is broad and gently rounded, much like that of *Dasypus*, but not extending so far behind the condyle; the masseteric fossa has an elevated and anterior position and is quite well defined. The coronoid process is high, narrow, erect and not at all recurved, ending in a bluntly rounded tip; the linea obliqua externa passes over upon the outer side of the coronoid near its upper end and forms a smooth, raised area. The condyle is almost sessile, not set upon a long neck, as it is in *Dasypus*, but resembles that of the latter in shape; the sigmoid notch is shallow.

The hyoid apparatus is, in some respects, peculiar, but is not unlike that of *Dasypus*. As in the latter, the anterior cornu consists of only two elements, but the proportions are different, the proximal piece being longer and the distal much shorter. The former is stout, compressed and plate-like above, contracted and nearly cylindrical at the distal end. The second element, probably the cerato-hyal, is a very short, subcylindrical bone, articulating loosely with the basi-hyal, which is broad in both directions and larger than in the modern genus, and gives off a short median, posterior projection. The posterior cornu consists of a single element, the thyro-hyal, which is fused with the basi-hyal and is elongate and much more slender than the proximal element of the anterior cornu; its proximal end is slightly thickened and club-shaped, while the remainder is laterally compressed.

As in *Dasypus*, the thyroid cartilage is completely ossified into a very thin, but dense and smooth bone, which forms somewhat more than half of a hollow cylinder and lies, apparently in its natural position, against the ventral side of the axis; the posterior border has a deep median notch. On the dorsal side, near the hinder end, the bone is perforated by a pair of small foramina, which were probably for the passage of the laryngeal nerves.

MEASUREMENTS.

Cranium, length to anterior rim of orbit..	.065	Forehead, width....................	.057
" width at zygomatic processes..	.056	Mandible, depth below $\overline{7}$............	.017
Occiput, height....................	.041	" thickness below $\overline{7}$..........	.010
" width at base..............	.046	" width of ascending ramus....	.030
" " across condyles.......	.040	" height of condyle...........	.042

Vertebral Column. — In the type-specimen the backbone is complete to and including the first sacral. As a whole, the presacral region is short and massive, resembling that of *Dasypus*, but on a much larger scale. The neck is short and, in its usual position, directed steeply downward and backward and making a sharp angle with the thoracic region, which rises very abruptly in the anterior part and is strongly curved. For the rest of its course the thoracic region is moderately curved, while the loins are short, heavy and nearly straight. The sacrum, as is shown by other specimens, is very long and the tail, which is imperfectly known, is rather short but stout. The vertebral formula is: C 7, Th 11, L 3, S 9.

The atlas is short longitudinally and very broad transversely. As in most armadillos, the sides are high and are nearly at right angles with the neural and inferior arches; the former arch is broad but deeply emarginated between the anterior cotyles and the spine is almost obsolete. The anterior opening of the vertebrarterial canal is a conspicuous foramen on the side of the atlas. The transverse processes are like those of *Dasypus*, but relatively better developed.

The axis is coössified with the third and fourth cervicals and the compound mass is shorter than in *Stegotherium*, with broad depressed centra, moderate ventral keel and lateral ridges that converge forward. The cotyles for the atlas extend farther below the centrum than in *Stegotherium*. The pedicles of the neural arch are rather narrow and are each perforated by a foramen ; the spine is not much elongated antero-posteriorly, but is very high, much higher than in *Dasypus*, and belongs almost entirely to the axis. The transverse process is considerably longer than in *Stegotherium*, but is comparatively slender for most of its length, thickened and club-shaped at the free end ; the anterior opening of the arterial canal is lateral, not ventral.

The fifth cervical has a short, broad, depressed centrum, which on each side extends out beyond the centrum of the fourth vertebra, clasping it behind, as it were; posteriorly, it is itself clasped in the same fashion by the sixth, giving the ventral side of these vertebræ a very peculiar appearance. Something of the same kind may be observed in *Dasypus* and, more distinctly, in *Priodontes*. The centrum of the fifth cervical is somewhat concave from side to side and the transverse process is a long, depressed plate, which extends almost directly out from the centrum with very little backward inclination ; the neural arch is extremely slender and the neural spine distinct.

The sixth cervical resembles the fifth, but has a shorter, wider centrum, somewhat heavier transverse process and a thread-like neural arch, without spine.

The seventh cervical considerably exceeds the sixth in every dimension. On each side of the centrum is a rugosity, which bears a facet for the head of the first rib, and the transverse process is long and heavy and somewhat thickened at the distal end. The neural arch is not quite so slender as that of the sixth and there appears to be no spine.

The first thoracic vertebra has a short, broad centrum, which, however, is narrower and longer than that of the last cervical, and is decidedly opisthocœlous ; the transverse process is very large, projecting far out from the side of the centrum and much produced vertically ; it bears a large, saddle-shaped facet for the connate head and tubercle of the peculiar first rib. This vertebra has the longest neural spine of any in the entire column ; this spine is thin and compressed, becoming very slender near the end, though the tip is slightly thickened, and is almost vertical. The second thoracic is steeply inclined upward from the first and has a considerably longer and narrower centrum, which contracts posteriorly.

The transverse process is very large, though somewhat smaller than that of the first, and its dorsal border is upturned, as if to form an incipient metapophysis. The zygapophyses are adapted to the very oblique position of the vertebra, the anterior pair being placed at a much lower level than the posterior, and this same obliquity makes the end of the spine rise a little higher than that of the first, though the spine itself is slightly shorter, less tapering and of a more uniform width.

The succeeding thoracic vertebræ have smaller centra, which are short, broad, depressed and opisthocœlous; they increase in size posteriorly, so that in the hinder part of the region they are almost as large as the lumbars. The obliquity of position continues as far as the fifth vertebra, which marks the summit of the arch, its spine rising higher than any of the others. The neural spines became successively shorter and, as far back as the sixth thoracic, are increasingly oblique in direction. While the spines of the first two vertebræ are parallel, from the second to the sixth they are very divergent, radiating almost like the sticks of a fan, though less regularly. This arrangement of the spines is such as to suggest a distinct hump at the shoulders, for there is a sudden descent from the sixth to the seventh, and the lowest point in the upper line of the back is at the tenth thoracic, behind which the line rises slightly to the sacrum. In modern genera the line connecting the ends of the neural spines is a gentle and nearly uniform curve; except in *Priodontes*, in which it is somewhat irregular.

In the hinder part of the thoracic region the spines are shorter, much broader and heavier than in the forward part. The transverse processes grow smaller posteriorly and are not conspicuous behind the sixth vertebra; their place is taken by the metapophyses, which begin to be prominent on the seventh, growing larger on each successive vertebra, and are extremely long and heavy, almost as much so as in *Priodontes*, and rise more steeply than in that genus. The accessory articular processes do not differ in any significant way from those of *Stegotherium*.

The three lumbar vertebræ have short and depressed, but broad and heavy centra, with ventral ridges, which are most prominent on the second; the transverse processes are very short, curving forward and downward and ending in bluntly rounded points; the metapophyses are extremely long and heavy, rising steeply upward and outward and slightly forward, and ending in club-shaped tips for the support of the massive carapace. The neural spines are considerably longer and heavier than in *Stegotherium*; posteriorly they increase in height, but diminish in breadth and thickness; they also become less steeply inclined.

In none of the specimens can the number of sacral vertebræ be exactly determined, but it appears to be nine; the first two vertebræ articulate with the ilia, then follow four having no connection with the pelvis, succeeded by three which are fused with the ischia. As a whole, the sacrum has a moderate fore-and-aft curvature. The first sacral has a broad, heavy and depressed centrum, with large pleurapophyses which are indistinguishably fused with the ilia. In the succeeding vertebræ the centra are much contracted and have a strong ventral keel, while that of the last sacral is broader and less depressed than that of any other except the first. The neural spines have coalesced into a ridge, which is very much higher and thicker than in *Stegotherium*, with sinuous dorsal border thickened at intervals. Prezygapophyses are present on the first vertebra, with well developed metapophyses rising from them, and postzygapophyses on the last.

No caudal vertebræ have been found in association with this species.

MEASUREMENTS.

Neck, length on ventral side	.058
Atlas, length on outer side	.018
" width	.048
Compound cervical, length	.026
Compound cervical, breadth of neural spine	.023
Axis, width of anterior face	.032
Fifth cervical, length of centrum	.006
" " width of anterior face	.025
Sixth cervical, length of centrum	.005
" " width of anterior face	.0255
Seventh cervical, length of centrum	.007
" " width of anterior face	.026
Trunk, length in straight line	.184
" " along dorsal curve	.207
First thoracic, length of centrum	.010
" " width of anterior face	.025
" " height of neural spine	.065
Second thoracic, length	.012
Second thoracic, width of anterior face	.027
" " height of neural spine	.058
Eleventh thoracic, width of posterior face	.022
Eleventh thoracic, width over metapophyses	.066
Eleventh thoracic, height of neural spine	.044
First lumbar, length of centrum	.015
" " width of posterior face	.022
" " height of neural spine	.048
First lumbar, width over metapophyses	.070
Second lumbar, length of centrum	.017
" " width of posterior face	.023
" " height of neural spine	.050
" " width over metapophyses	.074
Third lumbar, length of centrum	.0145
" " width of posterior face	.025
" " height of neural spine	.070

Ribs and Sternum (Plate X). — In general, the limbs resemble those of *Dasypus*, but are relatively larger and heavier. The first rib is the usual short, broad plate, with head and tubercle coalesced, and articulating directly with the sternum. The succeeding ribs are long, broad and laterally compressed, with vertical groove and prominent posterior border, somewhat as in *Tatu*. The sternal ribs are completely ossified and form heavy bars of bone, which increase in length posteriorly; as in *Dasypus*, five pairs of these ribs join the sternum directly.

While the sternum is of typically armadillo-like character, it has certain peculiarities. The presternum is a very broad, shield-shaped plate, which suddenly contracts to the junction with the mesosternum; its anterior border is broadly and quite deeply emarginate, having projections for articulation with the clavicles. On the ventral surface two ridges run from these projections, converging backward, and between them the ventral surface is concave, while that of the broad wings which articulate with the first pair of ribs is convex. The mesosternum consists of four segments; the shape cannot be clearly made out, but they appear to be like those of *Dasypus*, broad dorsally and narrowing ventrally. The xiphisternum is also shaped much as in the recent genus, but is relatively broader and more flattened; anteriorly, it has two well-marked facets for the sternal ribs.

Appendicular Skeleton.—The scapula is large, with broad blade unequally divided into a larger prescapular and smaller postscapular fossa, and with postero-superior angle extended into a broad, curved sickle-shaped process, which is relatively larger than in *Dasypus*. The neck is broad, the coraco-scapular notch much shallower than in the latter or *Priodontes*, and the coracoid border is raised, making the prescapular fossa more deeply concave than in either of the recent genera. The spine is high and its free border is turned back at nearly a right angle, making the border very wide, much wider than in *Priodontes*, in which something of the same kind occurs. At the level of the glenoid cavity the spine gives off a triangular metacromion. As is usual in this order, the acromion is very elongate, though not in such an exaggerated degree as in the last named genus, and is of a different shape, not being so much compressed, while its external surface is broader than in *Dasypus*. The raised glenoid border makes a second spine, which is considerably more prominent than in any recent genus with which I have been able to compare it. The coracoid is remarkably long and is a simple, curved, antero-posteriorly compressed hook, which, though not so broad, is otherwise much larger than in *Priodontes*.

The clavicle is unusually well developed and is long, stout and simply curved, somewhat enlarged at the extremities, especially the scapular end.

The humerus (Plate XIV, fig. 1) is of the usual armadillo type, but differs in some respects from that of any recent genus. The head is relatively broader and more prominent than in *Priodontes;* the external tuberosity is much larger than the internal, which articulates extensively with the acromion ; the bicipital groove is much narrower than in *Dasypus* or *Priodontes* and is brought so far to the inner side as hardly to be visible when the bone is seen from the front. The shaft is heavy and, for most of its length, much compressed laterally ; the broad distal portion is unusually concave on the posterior side ; the deltoid ridge is very prominent and ends in a large, overhanging hook, which is much larger than in the recent genera ; the supinator ridge, though very prominent, is less developed than in *Priodontes ;* the internal epicondyle is massive and the foramen conspicuous. The trochlea is broad and low, resembling that of *Dasypus* and *Priodontes*, except that the convexity for the head of the radius is less hemispherical.

Ulna and radius (Plate XIV, figs. 2, 3) are in contact only at the ends, thus forming a well-defined radio-cubital arcade. The former is nearly as long as the humerus, which is principally due to the great length of the olecranon ; this process is compressed and plate-like, but with broad and heavy posterior border and deep channels on both sides ; the proximal end is broadened, terminating in a large, incurved hook, which is larger than in any other known armadillo ; the sigmoid notch is quite deep, but relatively narrow. The shaft is nearly straight and laterally compressed, but very thick antero-posteriorly, with somewhat broader distal end.

The radius is very short and has a transversely expanded head, with more simply concave facet than in *Dasypus.* The proximal portion of the shaft is quite slender, but it gradually thickens (in the antero-posterior dimension) toward the distal end, and is somewhat arched forward. The distal end is suddenly broadened and has quite distinctly separate facets for the scaphoid and lunar ; the styloid process is prominent, but not so elongate as in *Priodontes.*

The manus (Plate XIV, fig. 4) is pentadactyl and of the *Dasypus* type, showing no tendency to the peculiar modifications seen in *Cabassous* and *Priodontes.* The carpus resembles that of *Dasypus* almost exactly. The scaphoid is broad, but very short proximo-distally, and has the external angle produced obliquely downward between the lunar and trapezoid to a contact with the magnum; the distal end is almost all occupied by the large facet for the trapezoid, internal to which is a much smaller one for the trapezium. The lunar is narrow on the dorsal side, much broader on the palmar; the facet for the radius is convex, descending well upon the dorsal face; this bone rests principally upon the extension of the scaphoid, but also covers the proximal end of the magnum and has a narrow contact with the unciform. The pyramidal is very broad and receives a peculiar appearance from its numerous articular surfaces; the ulnar facet is broad transversely, narrow palmo-dorsally, and posterior to it is the large, almost plane facet for the pisiform; on the distal side is a large, concave facet for the unciform and external to this, a prominent projection which articulates with metacarpal V. The pisiform is not unlike that of *Dasypus*, but relatively longer; it is laterally compressed and curved and tapers to a blunt point at the free end, while the other end is broadened to form the large facets for the ulna and pyramidal.

The trapezium is long, narrow and quite thick, widening somewhat at the distal end; its articulation with the scaphoid is lateral rather than proximal, and distally it extends somewhat below the trapezoid, so as to reach metacarpal II. The trapezoid is short, but very broad, occupying nearly the full width of the scaphoid; dorsally, it has little or no contact with the trapezium, but articulates with metacarpal III. The magnum is the smallest bone of the distal row, its dorsal face is nearly square, with rounded angles; proximally, it articulates with the scaphoid and lunar, distally, only with metacarpal III. The unciform is quite large and its dorsal face is wedge-shaped, thinning away to the ulnar side; it is much narrower than the pyramidal, but longer proximo-distally.

As in all the recent armadillos, there is a very large palmar sesamoid which is broader and has a more regularly oval shape than that of *Dasypus*.

The metacarpals are relatively much stouter than in *Dasypus;* in order of length the arrangement is III, II, IV, I, V, but this order is not that of the complete digits, the phalanges of the second digit more than compensating for its shorter metacarpal and giving the order, II, III, IV, I, V.

Metacarpal I is much the most slender of the series; the proximal end is rather broad, the shaft narrowing to the distal end, which slightly expands to form the trochlea, which is smooth, slightly convex and without carina.

Metacarpal II is very much longer and heavier; the proximal end is narrow, but thick palmo-dorsally, and is covered by the trapezoid facet, which is quite deeply grooved in the median line and thus divided into two parts; there is no contact with the magnum, but on the radial side a connection with the trapezium. The shaft, which is rather narrow and thick proximally, becomes broader and thinner distally; the trochlea is very low and has a small palmar carina.

Metacarpal III is the longest of the series; it resembles metacarpal II in shape, but is much stouter, a difference which is more pronounced than in *Dasypus;* the proximal end has a deeply concave facet for the magnum, with a projection on each side of it, one of which articulates with the trapezoid and the other with the unciform; the shaft is heavy and of nearly uniform width, except for the broadening of the distal end; the trochlea is very low, concave transversely, and has a small keel.

Metacarpal IV is much shorter than metacarpal III, but relatively longer than in *Dasypus* and of a different shape; it is very heavy, much the stoutest of the whole series; the proximal end has a broad contact with the unciform and is additionally widened by a projection which fits into a notch on the shaft of metacarpal III. The shaft is very heavy, slightly constricted above the middle and wider at the ends; the trochlea is peculiar in having two concavities, separated by a ridge.

Metacarpal V is much the shortest of all and of a very modified shape, being pyramidal, with base turned to the radial side and apex toward the ulnar; as in other armadillos, its articulation with the unciform is lateral and proximally it connects with the pyramidal.

The phalanges are much specialized and differ in almost every digit, though those of digits II and III are quite similar. The proximal phalanx is much longer and more slender in the pollex than in the other digits and is less reduced than that of *Dasypus;* the surface for the trochlea of metacarpal I is ungrooved and nearly plane. In digit II this phalanx is shorter and much heavier, and is shorter, stouter and less compressed than in the modern genus; the proximal trochlea is deeply invaded from the palmar side by a groove for the metacarpal carina, almost dividing it into two facets. In digits III and IV the first phalanx is broad and far shorter than that of digit II, and is considerably larger in the third digit than in the fourth, its proximal trochlea resembling the corresponding surface in digit II, while in digit IV it is very peculiar, having two prominent convexities, which fit into depressions on the end of metacarpal IV. In digit V the first phalanx is so short as to be hardly more than a broad disc. It is thus apparent that the proximal phalanx is successively shortened in each digit from I to V, with an abrupt change between II and III.

The second phalanx is most slender and elongate in digit II, in which it is slightly longer and much more slender than the first phalanx, but otherwise like it in shape. In digit III the second phalanx is much shorter (though longer than the proximal one), very much broader and more depressed, while in digit IV it is narrower and less depressed than in III. In digit V it is of a different shape, contracting more toward the distal end.

The ungual phalanges are not unlike those of *Dasypus*, but are heavier, less decurved and have smaller subungual processes. In the different digits the unguals differ little save in size; the largest is that of digit III; in digit IV it is very little smaller, while that of II is considerably smaller. Next in order comes the ungual of digit V, and that of digit I is very much the smallest of the entire series. The distal end of each ungual is cleft by a very short and shallow sulcus.

MEASUREMENTS.

Scapula, height	.085
“ greatest width	.078
“ width of neck	.027
Scapula, antero-posterior diameter of glenoid cavity	.019
Humerus, length	.093
“ width of proximal end	.024
“ “ of distal end	.033
Ulna, length	.099
“ “ of olecranon	.041
“ width of olecranon at proximal end	.017
“ “ of distal end	.014
Radius, length	.060
“ width of proximal end	.016
“ “ of distal end	.017
Carpus, length (proximo-distal)	.013
“ width	.032
Metacarpal I, length	.013
“ “ width of proximal end	.007
“ “ “ of distal end	.005
Metacarpal II, length	.025
“ “ width of proximal end	.0065
“ “ “ of distal end	.008
Metacarpal III, length	.029
“ “ width of proximal end	.009
“ “ “ of distal end	.010
Metacarpal IV, length	.017
“ “ width of proximal end	.010
“ “ “ of distal end	.010
Metacarpal V, length	.008
“ “ width of proximal end	.005
“ “ “ of distal end	.009
Proximal phalanx, digit I, length	.018
Proximal phalanx, digit I, width of proximal end	.006
Proximal phalanx, digit II, length	.015
Proximal phalanx, digit II, width of proximal end	.008
Proximal phalanx, digit III, length	.008

MEASUREMENTS.

Proximal phalanx, digit III, width of proximal end	.010
Proximal phalanx, digit IV, length	.0065
Proximal phalanx, digit IV, width of proximal end	.012
Proximal phalanx, digit V, length	.004
Proximal phalanx, digit V, width of proximal end	.0095
Second phalanx, digit II, length	.012
Second phalanx, digit II, width of proximal end	.009
Second phalanx, digit III, length	.009
Second phalanx, digit III, width of proximal end	.011
Second phalanx, digit IV, length	.009
Second phalanx, digit IV, width of proximal end	.010
Second phalanx, digit V, length	.008
Second phalanx, digit V, width of proximal end	.009
Ungual phalanx, digit I, length	.016
Ungual phalanx, digit I, width of proximal end	.0065
Ungual phalanx, digit II, length	.025
Ungual phalanx, digit II, width of proximal end	.0095
Ungual phalanx, digit III, length	.032
Ungual phalanx, digit III, width of proximal end	.011
Ungual phalanx, digit IV, length	.030
Ungual phalanx, digit IV, width of proximal end	.0095
Ungual phalanx, digit V, length	.021
Ungual phalanx, digit V, width of proximal end	.008
Digit I, length	.048
" II, "	.080
" III, "	.074
" IV, "	.058
" V, "	.040

As the pelvis is missing from the type-specimen, the following description is taken from another individual (Plate XV, figs. 1, 2), which is referred to this species on account of its large size. This pelvis is strikingly different from that of any other Santa Cruz genus, especially in the development of the ischia. The ilium has a rather short, broad and depressed peduncle, which expands anteriorly into a broad, vertical plate, with elongate, thickened, rugose crista, which is less everted than in *Stegotherium* and is not so club-like, but rising much higher above the sacrum to the level of the lumbar metapophyses, and was evidently adapted to the support of the heavy carapace; the gluteal surface is smaller than in the last-named genus and the sacro-sciatic foramen larger, and the ilio-pectineal processes are much less prominent. The acetabulum is relatively small and of nearly circular shape, with prominent borders; the sulcus for the round ligament is deep, but not very large. The ischium has a considerably shorter peduncle than the ilium, which is laterally compressed and broad; it rapidly expands into a great vertical plate, the free border of which describes an arc of about 120° and rises far above the sacrum; most of this border is extremely thick and rugose and obviously supported the massive pelvic buckler. For most of its length the pubis is very slender and is directed more backward and less ventrally than in *Dasypus;* posteriorly it becomes quite broad and forms a more elongate symphysis than in the recent genus. The obturator foramen is relatively small and of elongate oval shape, with long axis antero-posterior.

The femur (Plate XV, fig. 3), which is taken from still another individual (No. 15,389) is as remarkable as the pelvis; it is rather short, very heavy, antero-posteriorly compressed and with enormous processes for muscular attachment. The head is small, is set upon a short, cylindrical neck and presents upward as much as inward and has also a decided anterior inclination; the pit for the round ligament is small, deep, and posterior in position; the great trochanter is immensely developed, rising far above the head; and is laterally compressed, with its principal diameter in the fore and aft direction; this same diameter increases toward the proximal end of the process, but the free border is only moderately rugose. A slight depression on the posterior side represents a vestige of the digital fossa, but there is no distinct intertrochanteric line. The second trochanter, which also is very large, is much more prominent than in *Stegotherium* and is separated from the head by a deep notch, which is not present in the latter. The third trochanter arises far down upon the outer side of the shaft and, though rather narrow in the proximo-distal dimension, is of a very unusual prominence and projects outward very abruptly; the free end is thickened and curved forward, making the anterior surface concave. The distal edge of the process is continued down the shaft as a thin, but very prominent ridge, which reaches its greatest development above the external condyle, recalling the supinator ridge of the humerus. From the inner side of the shaft, above the condyle, is given off a small, but prominent and rugose hook. Although it is much compressed antero-posteriorly, the shaft is very broad and heavy; the posterior surface is nearly plane, while the anterior has a strong median convexity, which runs obliquely from the great trochanter to the inner condyle. The rotular groove is short, but quite broad and concave, with raised inner border. The condyles are very small and widely separated.

The patella has considerable resemblance to that of *Dasypus*, but is relatively less elongate, broader and much thicker; it also tapers less and the distal end is broader and less pointed. On the posterior side the facet for the femoral trochlea has a prominent median ridge.

Though nearly as long as the femur, exclusive of the great trochanter, the tibia (Plate XV, fig. 4) is shorter than in *Stegotherium;* the proximal end is broad and heavy, the facets for the femur well separated and without a spine. The cnemial crest is extremely long and prominent, extending down more than three fourths of the length of the shaft and with anterior border curved outward, making the external side unusually concave. The shaft is much compressed laterally, very thick antero-posteriorly, except at the distal end, where these proportions are reversed. An interosseous crest runs down the outer side of the shaft, for most of its length a mere linea aspera, but becoming very prominent near the distal end. A corresponding crest appears upon the inner side of the fibula and at the distal end the united crests are notched to form a subcircular opening, so that in this region the coössification of the two bones is much less extended proximo-distally than in *Stegotherium.* The astragalar facets are moderately concave and are separated by a low intercondylar ridge; the internal malleolus is almost obsolete, but a stout and prominent tongue arises from the plantar end of the intercondylar ridge, and internal to this is a shallow tendinal sulcus.

The fibula (Plate XV, fig. 4) is of very irregular shape and has a sigmoid curvature; the shaft is very narrow transversely, much extended antero-posteriorly, especially at the proximal end, and diminishing distally; the proximal portion of the shaft is deeply concave on the inner side; below this arises the interosseous crest already described. On the outer side is a prominent ridge, which ends distally in an overhanging hook, separated from the external malleolus by a sulcus. The distal end is broad and thick, forming a stout malleolus; distally this process has a facet for a shelf-like projection from the outer side of the astragalus and, posterior to this, another and smaller facet for the calcaneum.

In some other species of the genus the pes is very completely preserved, but for *P. robustus* the material available consists of only a calcaneum and an astragalus. Since the differences are almost altogether in size, the description of the hind-foot will be given in connection with the next species.

Restoration (Plate XI). — The skeleton has a very massive appearance, almost equalling that of *Priodontes.* Despite its elongate, tubular rostrum, the head is very heavy, the neck short and thick and the trunk likewise short and massive and characterized by the hump at the shoulders, the unusually long neural spines and metapophyses and the broad, plate-like ribs. The tail is apparently short and evidently thick. The limbs are short and very heavy, and are remarkable for the great development of the processes for muscular attachment, and the pelvis is exceedingly large.

In the following table the measurements except those of the pelvis are from No. 15,389.

MEASUREMENTS.

Pelvis, length	.180
" width at acetabulum	.095
Ilium, length	.099
" width of anterior plate	.046
" " of peduncle	.019
Ischium, length	.081
" width of posterior expansion	.105
" thickness of expansion	.021
Acetabulum, antero-posterior diameter	.022
Pubis, length	.065
Sacro-sciatic foramen, length	.060
Obturator foramen, length	.050
Femur, length from head	.109
" " " great trochanter	.126
" width of proximal end	.034
Femur, width of distal end	.040
Tibia, length	.087
" width of proximal end	.035
" and fibula, width of distal end	.030
Fibula, thickness of proximal end	.017
" " of distal end	.013
Astragalus, length	.023
" width of trochlea	.020
" " of head	.012
Calcaneum, length	.042
" width of proximal end	.019
" dorso-plantar diameter proximal end	.010
" width of distal end	.016

Proeutatus œnophorus Ameghino.

(Plates XII, Figs. 1–6, XIV, 5, 6.)

Eutatus œnophorum Amegh; Enumeracion sistematica, etc., 1887, p. 25.
Eutatus bipunctatus Amegh; Ibid.
Proeutatus œnophorum Amegh; Revista Argentina de Historia Natural, 1891, p. 327.
Thoracotherium priscum Mercerat; Revista del Museo de La Plata, II, 1891, p. 43.
Thoracotherium œnophorum Mercerat; Ibid., p. 44.
Eutatus œnophorum; Lydekker; Anales del Museo de La Plata, T. III, 1894, p. 64.

The movable scutes have markings very similar to those of *P. robustus;* narrow and shallow, but very distinct grooves form a figure which Ameghino has aptly compared to a flask, with the neck directed forward and the body occupying nearly the whole breadth of the posterior half of the plate, with only a very narrow raised border on the outer side of each bounding groove; anteriorly, on each side of the neck of the flask, is a nearly square, flat figure. Backward from the neck of the flask passes a faintly marked ridge, tapering posteriorly and ending in a point some distance in advance of the hinder border of the plate. In the anterior median part of the carapace the flask-figure is not distinct and the conspicuous, piliferous pits (already described in *P. robustus*) are present, but in the posterior region of the movable bands this pattern occurs across the entire width of the carapace. On the sides, where the plates become curved, the flask-shaped figure is somewhat distorted and has an elongate neck.

In the fixed plates of the pelvic buckler, the flask is less distinct, while the small anterior figure on each side of the neck is divided into two and in some instances the neck itself is severed by a transverse groove, making five small, anterior figures.

The upper teeth (Plate XII, figs. 2, 6) of each side form an almost continuous series and the space between $^{\underline{1}}$ and $^{\underline{2}}$ is very short, hardly longer than that between $^{\underline{2}}$ and $^{\underline{3}}$; $^{\underline{1}}$ is very small and implanted entirely in the premaxillary, as in *Dasypus*: $^{\underline{2}}$ is considerably larger than $^{\underline{1}}$ and $^{\underline{3}}$ still larger and faintly grooved on the inner side, $^{\underline{4}}$ is symmetrical, with opposite vertical grooves, while $^{\underline{5}}$ to $^{\underline{8}}$ inclusive are pyriform, with the smaller end turned obliquely forward and inward: $^{\underline{6}}$ is the largest of the upper series and behind this the teeth diminish in size to $^{\underline{9}}$, which is oval. In the mandible (Plate XII, fig. 5) the first four teeth are small and laterally compressed, though increasing successively in size and thickness, while $_{\overline{5}}$ is much larger. The five posterior teeth have the usual rudely triangular shape, with rounded angles. The lower dentition slightly exceeds the upper in length.

The skull (Plate XII, figs. 1–4) is somewhat smaller than that of *P. robustus*, but of very similar form. The occiput has a prominence for the vermis of the cerebellum, but no nuchal ridge, and the median dorsal fossa is much narrower and shallower than in the last-named species, while the sagittal crest and area are less prominent. The rostrum is long and tubular, but slightly expanded and spatulate at the tip, which is a very characteristic feature of this species. The nasals are long, narrow and splint-like, and to their anterior broadening is principally due the spatulate shape of this portion of the rostrum. The premaxillaries are very long and quite broad, but low dorso-ventrally; the alveolar border is continued as a delicate ridge for a short distance in front of the first tooth, and in this region the palatal processes are transversely concave, but for most of their length there is no distinct separation between the palatal and lateral surfaces. The incisive foramina are small and very narrow slits, separated by a slender spine, and the anterior nares are broad and low.

The mandibular symphysis is short and the edentulous portion of each ramus, which has a narrow and sloping dorsal border, tapers forward very rapidly, becoming slender and compressed and terminating in a rounded point.

The following measurements of the skull and dentition were obtained by combining two individuals, which were found in the same block of matrix. One of these specimens comprises the anterior part of the rostrum, with the first four teeth and the mandible; the other is the skull complete to $^{\underline{2}}$ on the left side and to $^{\underline{4}}$ on the right side. The same number, 15,491, has been given to both.

MEASUREMENTS.

Upper dentition, length	.048	Cranium, width at zygomatic process	.038
“ “ “ $^{\underline{1-4}}$	.021	Forehead, width	.045
Lower dentition, length	.052	Occiput, height	.037
“ “ “ $_{\overline{1-4}}$	.018	“ width at base	.044
Skull, length on median basal line	.103	“ “ over condyles	.037
“ extreme length	.126	Mandible, length of symphysis	.015
Cranium, length to anterior rim of orbit	.059	“ depth of ramus below $_{\overline{7}}$	.012
Face, length	.067	“ thickness of ramus below $_{\overline{7}}$	.009
Rostrum, width at anterior end	.018		

Associated with the skulls above mentioned and doubtless belonging to one or other of them, are the fore- and hind-feet, the right ulna entire and most of the left, and parts of both radii. A peculiarity of the fore-arm in this species is the manner in which the ulna and radius are closely applied throughout their length, not forming a radio-cubital arcade; in the left fore-arm the two bones are coössified, which is doubtless an abnormality. The radius is strikingly slender, except at the distal end, which is much expanded, to cover the scaphoid and lunar.

The manus (Plate XIV, fig. 5) is characterized by the slenderness of the digits, especially of the first, or radial three. The ungual phalanges are narrow, elongate and sharply pointed and form a striking contrast to the massive and powerful claws of *P. robustus*.

Measurements.

Ulna, length	.083
" " of olecranon	.034
" width of distal end	.010
Radius, width of distal end	.0175
Metacarpal I, length	.012
" " width of proximal end	.005
" " " of distal end	.0045
Metacarpal II, length	.021
" " width of proximal end	.005
" " " of distal end	.007
Metacarpal III, length	.026
" " width of proximal end	.008
" " " of distal end	.0085
Metacarpal IV, length	.013
" " width of proximal end	.009
" " " of distal end	.010
Metacarpal V, length	.005
" " width of proximal end	.005
" " " of distal end	.007
Proximal phalanx, digit I, length	.015
Proximal phalanx, digit I, width of proximal end	.004
Proximal phalanx, digit II, length	.014
Proximal phalanx, digit II, width of proximal end	.007
Proximal phalanx, digit III, length	.008
Proximal phalanx, digit III, width of proximal end	.009
Proximal phalanx, digit IV, length	.0065
Proximal phalanx, digit IV, width of proximal end	.0095
Proximal phalanx, digit V, length	.005
Proximal phalanx, digit V, width of proximal end	.008
Second phalanx, digit II, length	.015
Second phalanx, digit II, width of proximal end	.0075
Second phalanx, digit III, length	.009
Second phalanx, digit III, width of proximal end	.009
Second phalanx, digit IV, length	.0085
Second phalanx, digit IV, width of proximal end	.009
Second phalanx, digit V, length	.007
Second phalanx, digit V, width of proximal end	.007
Ungual phalanx, digit I, length	.014
Ungual phalanx, digit I, width of proximal end	.0045
Ungual phalanx, digit II, length	.021
Ungual phalanx, digit II, width of proximal end	.007
Ungual phalanx, digit III, length	.025
Ungual phalanx, digit III, width of proximal end	.0075
Ungual phalanx, digit IV, length	.0235
Ungual phalanx, digit IV, width of proximal end	.0075
Ungual phalanx, digit V, length	.018
Ungual phalanx, digit V, width of proximal end	.007
Digit I, length	.040
" II, "	.068
" III, "	.063
" IV, "	.049
" V, "	.033

In the Ameghino collection are the femur, tibia and fibula of this species, associated with the facial region of the skull and the mandible of an individual very slightly smaller than the one above described, the upper dentition measuring 47 mm. and the lower 51 mm. The following measurements are from this specimen.

Measurements.

Femur, length from head	.094
" " " great trochanter	.108
" width of proximal end	.035
" " of distal end	.023
Tibia, length	.082
" width of proximal end	.032
" and fibula, width of distal end	.026

The pes (Plate XIV, fig. 6) has much resemblance to that of *Dasypus*. The astragalus is stout and very broad, decidedly more so than in *Stegotherium*, while the trochlea is less distinctly grooved and has a less raised inner border; a deep sulcus invades the outer condyle from behind. From the outer side arises a prominent projection, which bears a concave, dorsally presenting facet for the fibula. The external calcaneal facet is very concave and oblique and is separated by a deep groove from the large and slightly convex sustentacular facet. The neck is short, broad and depressed and bears on its dorsal side a facet, which is in contact with the tibia only when the foot is in extreme flexion; the distal head has a greater dorso-plantar diameter than in *Stegotherium*. The calcaneum is large and has quite an elongate tuber, its principal distinction from that of *Cabassous*, which otherwise it much resembles; this tuber is much depressed and flattened, far more so than in *Dasypus*, and is in very strong contrast to the laterally compressed tuber of *Stegotherium* and *Tatu;* it broadens rapidly to the free end, though hardly so much or so abruptly as in *Cabassous;* the proximal end has a distinct internal tubercle and, on the plantar side, a broad tendinal sulcus. The distal portion of the calcaneum is short, but very wide; the external astragalar facet is broad and simply convex; it is less oblique in position and reflected farther upon the dorsal side of the tuber than in *Stegotherium*, and it does not project so far outward as in the latter, while the fibular facet presents laterally, instead of dorsally. The sustentaculum is very large and only partially occupied by the facet, and the tubercle for the attachment of the lateral ligament is very prominent and distinctly grooved. The cuboid facet is broad transversely and short in the dorso-plantar diameter.

An accessory ossicle is attached to the tibial side of the navicular, proximal to the entocuneiform; it is large and compressed proximally, contracting to a blunt point distally, and resembling that of the recent *Zaëdyus* in form.

The cuboid is broad distally, narrowing proximally and thus has a somewhat pyramidal form, for the strongly convex calcaneal facet is very oblique and external, rather than proximal, in position.

The other tarsal bones, the navicular and cuneiforms, are of the usual armadillo type and require no particular description.

Metatarsal I is short and heavy; in length it almost exactly equals metacarpal I, but is broader and more depressed; the proximal end is the widest part of the bone and bears an oblique, saddle-shaped facet for the entocuneiform; the shaft is short and wide, contracting distally and the distal trochlea is narrow, concave and without a carina.

Metatarsal II is much longer than metatarsal I and slightly exceeds metacarpal II in length; the proximal end is broad and extends over the head of metatarsal III. Owing to the small size of the mesocuneiform, the head of metatarsal II is wedged in between the ento- and ectocuneiforms, with both of which it articulates. The shaft has an oblique appearance, on account of the deep pit on the fibular side for the head of metatarsal III, but widens much distally; the trochlea is low and broad, saddle-shaped, and with faintly marked carina.

Metatarsal III is much the longest of the series and somewhat longer than metacarpal III; the proximal end is broad and has a plane, obliquely placed facet for the ectocuneiform, while the depressed shaft narrows distally, but expands quite suddenly to form the broad, semicylindrical trochlea, which has a very low keel.

Metatarsal IV is a little shorter than metatarsal II, with which it forms a nearly symmetrical pair; it is therefore both actually and relatively much longer than metacarpal IV; the proximal end is widened by an extension to receive the head of metatarsal V, and the cuboid facet is plane and oblique; the shaft is depressed and contracts towards the middle, expanding again distally; the semicylindrical trochlea has the most prominent keel of the series.

Metatarsal V is but little shorter than metatarsal I and much longer than metacarpal I; it is broad and thick, with very low, saddle-shaped trochlea, and the keel is a mere tubercle.

The phalanges are less individualized than those of the manus, though they differ somewhat in the various digits. The proximal phalanx of the hallux, though slender and elongate, is less so than that of the pollex. In digit II this phalanx is somewhat shorter and much heavier, while in the other digits it is very short, broad and depressed and successively more so from the third to the fifth. The second phalanx is most elongate and slender in digit II, while in III, IV and V it is much shorter and wider; in these three digits it is of nearly the same length as the proximal and of similar depressed shape, but rather more slender.

The ungual phalanges are extremely characteristic and differ widely from those of the manus, being much shorter, wider, more depressed and flattened, of a peculiar trowel-like shape, and very bluntly pointed. No other known genus of Santa Cruz armadillos has similar claws. In the various digits the unguals differ little save in size.

The following measurements are taken from No. 15,491, except those of the astragalus, which have been supplied from another specimen (No. 15,553) which agrees with the first almost exactly in size.

MEASUREMENTS.

Astragalus, length	.018
" width of trochlea	.015
" " " head	.009
Calcaneum, length	.030
" width of proximal end	.015
" " " distal end	.013
Metatarsal I, length	.012
" " width of proximal end	.008
" " " " distal end	.006
Metatarsal II, length	.021
" " width of proximal end	.007
" " " " distal end	.007
Metatarsal III, length	.026
" " width of proximal end	.009
" " " " distal end	.0085
Metatarsal IV, length	.0215
" " width of proximal end	.007
" " " " distal end	.008
First phalanx, digit I, length	.013
First phalanx, digit I, width of proximal end	.006
First phalanx, digit II, length	.012
First phalanx, digit II, width of proximal end	.008
First phalanx, digit III, length	.009
First phalanx, digit III, width of proximal end	.010
First phalanx, digit IV, length	.008
First phalanx, digit IV, width of proximal end	.009
Second phalanx, digit II, length	.010
Second phalanx, digit II, width of proximal end	.007
Second phalanx, digit III, length	.0085
Second phalanx, digit III, width of proximal end	.009
Second phalanx, digit IV, length	.0075
Second phalanx, digit IV, width of proximal end	.0085
Ungual, digit I, length	.011
" " " width of proximal end	.007
" " II, length	.014
" " " width of proximal end	.0085
" " III, length	.018
Ungual, digit III, width of proximal end	.010
Ungual, digit IV, length	.016
" " " width of proximal end	.009
Digit I, length	.036
" II, "	.057
" III, "	.061
" IV, "	.054

PROEUTATUS LAGENA Ameghino.

(Plates XIII, Figs. 1–3, 7; XIV, Fig. 7; XV, Fig. 7, 8.)

Eutatus lagena Amegh.; Enumeracion sistematica, etc., 1887, p. 26.
Proeutatus lagena Amegh.; Revista Argent. Hist. Nat., T. I, p. 327.
Thoracotherium vetum Mercerat; Revista del Museo de La Plata, T. II, 1891, p. 44.

Thoracotherium lagenum Mercerat; Ibid., p. 45.

As originally described, this species was distinguished from the preceding one by its smaller size; more abundant material, however, showed that this supposed difference was illusory. Ameghino later defined it as having a tubular rostrum, not depressed or spatulate anteriorly, and as having the forward upper teeth, especially $^{\underline{1}}$, separated by longer interspaces than in *P. œnophorus*. As many specimens show, these are constant characters and there can be no doubt as to the propriety of separating the two species; but, on the other hand, it is far from clear that the names are now applied to the same species as those to which they were originally given. Since this point can hardly be determined, it seems best to accept Ameghino's nomenclature.

So far as it is known, the carapace of *P. lagena* has scutes of size and sculpture like those of *P. œnophorus* and, at present, no constant and characteristic difference between them can be pointed out.

The upper and lower dental series are of more nearly the same length than they are in *P. œnophorus* and in some specimens are exactly equal in this respect. $^{\underline{1}}$ is implanted at the suture between the maxillary and premaxillary, not chiefly in the latter, as it is in *P. œnophorus;* $^{\underline{1}}$ is separated from $^{\underline{2}}$ by a longer space than in the last named species, while $^{\underline{2}}$ and $^{\underline{3}}$ are also more widely separated and smaller in size. The remaining upper teeth are much alike in the two species and the differences between them are hardly greater than those between individuals.

In the skull (Plate XIII, figs. 1–3) the most characteristic feature of the present species is the elongate, tubular rostrum, which is but slightly, or not at all, broadened at the anterior end, and is thus quite different in appearance from the spatulate muzzle of *P. œnophorus*, while the whole edentulous part of the rostrum is narrower and more elongate than in the latter. In the occiput, the prominence for the vermis of the cerebellum is less developed, but the nuchal ridge is distinct, dividing the dorsal fossa into two pits. The mandibular symphysis is longer, the rami taper more gradually and are rather more bluntly pointed at the anterior end, while the edentulous dorsal border is wider, more flattened and less inclined; the constriction between the horizontal and the ascending ramus is most distinct in the present species; the angle is more prominent, the ascending ramus narrower and the notch between condyle and angle broader and deeper than in *P. robustus*.

So far as they are known, the vertebræ do not differ except in size, from those of the other species. The caudals (Plate XIII, fig. 7) are very scantily represented in any of the specimens referable to this species or even to the genus. It is evident, however, that the tail was not unlike that of *Dasypus* and altogether different from that of *Stegotherium*. In the more anterior part of the tail the vertebræ have very short, but very broad and heavy and slightly amphicœlous centra, very small neural canal, but well-developed arches and zygapophyses and long, slender transverse processes. These are succeeded by a number of vertebræ, which have centra of nearly the same length, but much narrower and more depressed, with only rudiments of the various processes, and growing gradually smaller towards the end of the tail.

The only available specimen of the pelvis of this species displays certain peculiarities, but it is very difficult to say how far they are due to crushing. The gluteal surface of the ilium is small and quite concave; the acetabular border presents externally, giving the iliac surface an oblique position, almost as much ventral as lateral; the ilio-pectineal process is better developed than in *P. robustus*.

The thigh-, leg- and foot-bones (Plates XV, figs. 7, 8; XIV, fig. 7) differ in no significant manner from those of the preceding species.

The dimensions given in the table below are from a specimen (No. 15,613), which includes a part of the carapace, the skull and mandible, the lumbar vertebræ and the anterior part of the sacrum and pelvis; it was collected by Mr. Peterson near Coy Inlet.

MEASUREMENTS.

Upper dentition, length	.0495	Face, length (ca.)	.071
" " " $\underline{1}-\underline{4}$	.0225	Mandible, length of symphysis (ca.)	.022
Lower dentition, length	.0515	" depth below $\overline{7}$	.015
" " " $\overline{1}-\overline{4}$	.017	" thickness below $\overline{7}$	.0095
Skull, length on median basal line (ca.)	.106	" width of ascending ramus	.025
" greatest length (ca.)	.127	" height of condyle	.040
Cranium, length to anterior rim of orbit	.055	Last thoracic, length of centrum	.013
		" " width of posterior face	.023
Cranium, width at zygomatic processes	.044	" " height of neural spine	.042
Occiput, height	.035	" " width over metapophyses	.054
" width at base	.040	First lumbar, length of centrum	.014
" " across condyles	.037	" " width of posterior face	.022
Forehead, width	.052	" " height of neural spine	.044

First lumbar, width over metapophyses	.060
Second lumbar, length of centrum	.016
" " width of posterior face	.022
" " height of neural spine	.049
Second lumbar, width over metapophyses	.064
Third lumbar, length of centrum	.014
Third lumbar width of posterior face	.022
" " height of neural spine	.046
" " width over metapophyses	.063
Ilium, length	.088
" width of anterior plate	.043
Sacro-sciatic foramen, length	.046
Pelvis, width at acetabula	.103

PROEUTATUS CARINATUS Ameghino.

(Plate VII, Fig. 4.)

Eutatus carinatus Amegh.; Revista Argentina de Hist. Nat., T. I, p. 254, 1891.

Proeutatus carinatus Amegh.; Énum. Synopt. de Mamm. Foss. de Patagonie, 1894, p. 175.

Of this very imperfectly known species, the only specimen that I have seen is the type in the Ameghino collection, which is a fragment of the carapace only. There can be no doubt, however, that this represents a distinct species, and very little that it is properly referred to the present genus.

The scutes indicate an animal of much the same size as *P. lagena*, but the sculpture is entirely different. In the movable plates the flask-shaped figure occurs, but the ridge which passes backward from the neck of the flask is very much more prominent. Still more characteristic is the pattern of the fixed plates of the pelvic shield; they have no flask-like figure, but two large and deep anterior pits, closely approximated and placed near the median line, and behind these is the prominent central ridge, shaped like a long and narrow spear-head, with point directed backward. Anteriorly, there is a broad, triangular figure, with its base occupying the whole front border of the plate, and two much smaller, square figures, one on each side of the pair of pits.

PROEUTATUS DELEO Ameghino.

(Plate XII, Figs. 10–12.)

Eutatus deleo Amegh.; Revista Argentina de Hist. Nat., T. I, p. 254, 1891.

Proeutatus deleo Amegh.; Énum. synopt. des Mamm. Foss. de Patagonie, 1894, p. 174.

This is another imperfectly known species, of which I have seen no specimens but those in the Ameghino collection, consisting of part of the mandible and a number of isolated scutes of the carapace. The flask-shaped figure is indicated either very obscurely, or not at all, and most of the plates have no definite sculptural pattern, but are coarsely pitted all over the exposed surface. The horizontal ramus of the mandible tapers anteriorly less than in any of the preceding species and the symphyseal part, though very thin, is deeper vertically. In size, this species slightly surpasses *P. œnophorus* and *P. lagena*.

PAREUTATUS gen. nov.

Premaxillary and corresponding mandibular teeth absent, giving the dental formula $\frac{8}{9}$; two rows of upper teeth nearly parallel; all of the teeth of elliptical shape, with long axis of ellipse directed antero-posteriorly, and non-lobate; grinding surface not displaying conspicuous alternations of hard and soft dentine.

PAREUTATUS DISTANS (Ameghino).

Eutatus distans Amegh.; Enumeracion sistematica, etc., 1887, p. 26.
Thoracotherium distans Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 45.
Thoracotherium cruentum Mercerat; Ibid.
Proeutatus distans Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 174.

This species, which is known to me only from the specimens in the Ameghino collection, an imperfect skull and some isolated scutes, has teeth of such a different character from those of *Proeutatus* as to forbid its reference to that genus, to which, however, it is evidently nearly allied.

The movable plates of the carapace have three longitudinal ridges, which do not always extend to the hinder edge of the scute, but may be cut off by a relatively broad, transverse, marginal ridge. The fixed plates of the pelvic buckler, if correctly referred to this species, have a posterior, nearly plane portion, on which the three longitudinal ridges are very faintly marked; this part is bounded in front by two oblique grooves, which give it a wedge-shaped anterior termination. The anterior part of the scute has five rather obscure figures, a larger median and, on each side of this, two smaller laterals.

The first upper tooth $^{\underline{1}}$, is separated from $^{\underline{2}}$ by a slightly greater space than those between the succeeding teeth, which are relatively small and of oval cross-section, non-lobate, so far as can be judged from $^{\underline{7}}$ and $^{\underline{8}}$, the only teeth in position, and from the alveoli of the others.

In size, this species is considerably smaller than any of those referred to the preceding genus.

PROZAËDIUS Ameghino.

(Plates V, VI, Figs. 1–18.)

Euphractus Amegh. (*non* Gervais) in part; Enumeracion sistematica, etc., 1887, p. 26.

Zaëdyus Amegh. in part; Contrib. al Conoc. d. Mam. Fos. de la Repúb. Argent., 1889, p. 867.

Prozaëdius Amegh.; Revista Argentina de Hist. Nat., T. I, 1891, p. 327.

Dasypus Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 55.

A genus of small armadillos very closely allied to the recent *Zaëdyus*, which was doubtless derived from some member of it.

Exoskeleton (Plates V, VI, figs. 2, 13, 14).—As usual in the Santa Cruz genera, the carapace has no anterior buckler, but is made up of at least fourteen, and probably more, movable bands; the pelvic buckler is relatively small and is composed of eight bands, including the marginals. The sculpture, which differs slightly in the various species, is essentially like that of the recent *Zaëdyus ciliatus.* In the movable bands, the plates of which are long and narrow, the pattern consists of three longitudinal ridges, of which the median one is the narrowest and most sharply defined, while the laterals show a more or less pronounced tendency to break up into rows of tubercles; the marginal scutes are smooth and marked only by a fine pitting. In the pelvic buckler the plates become shorter and relatively wider posteriorly, but they are throughout narrower and more elongate than in the recent species; the sculpture is that of the movable plates, modified by the conversion of the lateral ridges into rows of tubercles, which extend across the anterior border of the plate and thus reduce the length of the median ridge, which remains entire. The hindermost row of scutes forms a series of bluntly-pointed marginals, which retain the sculptural pattern much more distinctly than in the recent species.

The cephalic shield is composed of numerous small, irregularly polygonal plates, which do not overlap at all, but are in contact only by their edges; their markings are only very numerous minute pits.

Dentition.—The dental formula is $\frac{7-8}{10}$, and there are no premaxillary teeth. In form the teeth resemble those of the modern *Zaëdyus*, but are both relatively and actually smaller; the anterior teeth, especially $_{\overline{1}}$, $_{\overline{2}}$ and $_{\overline{3}}$, are very small and much compressed, but posteriorly the teeth increase in size; they are of compressed oval section, with the long axis of the ellipse directed antero-posteriorly; the grinding surface of most of the teeth is bevelled to a transverse edge, as in *Dasypus*, and displays two kinds of dentine, a denser layer on the periphery, which in the fossils is of a lighter color, and the softer, darker vaso-dentine, which forms most of the teeth and is often worn into a concave surface; in the center is a small spot of different appearance.

Skull (Plate VI, figs. 1–4, 15–17).—In general appearance, the skull is not unlike that of the recent *Zaëdyus*, but is decidedly more slender and elongate; the cranium is narrower and less capacious and the post-orbital constriction deeper and more abrupt; the rostrum is longer and more slender and tubular and the face narrows more suddenly in front of the orbits; the forehead is narrower and the frontal sinuses but moderately developed. Thus, the face is much shallower vertically and, consequently, the anterior descent to the rostrum is much less steep. The occiput is low and the upper profile of the skull rises but slightly to the parietal eminence, whence it descends gently and almost uninterruptedly to the end of the snout. In form, the occipital surface resembles that of *Zaëdyus*, but is lower, wider and more quadrate; it is convex and has a strong median protuberance for the vermis of the cerebellum, while near the dorsal summit is a broad, shallow concavity, which is much more distinct than in the modern genus. The foramen magnum is rather small and considerably wider than high and the occipital crest is not very prominent, but more so than in recent armadillos.

The basioccipital is broad behind, narrowing forward; it is nearly flat, with a fine, hair-like median keel, very different from the prominent keel and deep lateral fossæ of *Zaëdyus;* the condyles are sessile, transverse and very short; each is invaded, as in most armadillos, by a sulcus from the outer side and, a more peculiar feature, the medial end is notched in a way that gives a characteristic shape to the foramen magnum; no paroccipital process is formed. The supraoccipital is broad and low; its median upper portion is inserted between the diverging ends of the parietals and is so reflected as to present dorsally, but is clearly demarcated from the cranial roof proper by the forward curvature of the lambdoidal crest. The mastoid portion of the periotic ends in a long, recurved mastoid process, which is closely applied to the tympanic and forms the posterior wall of the external meatus. The tympanic is inflated into a small, but distinct bulla, thus agreeing with *Dasypus* and *Zaëdyus* and differing from the other recent genera ; the bulla is not so large as in the two modern genera named and is so far incomplete that it is deeply notched from behind in a very peculiar and characteristic manner; another difference from the two recent genera is in the shape of the external meatus, which is not a tube, but an irregular opening, the anterior lip of which is formed by the tympanic and the posterior by the mastoid and posttympanic processes.

The parietals are large, almost square bones, with finely pitted surface; posteriorly they form very short, wing-like extensions on each side of the supraoccipital; no sagittal crest is present, but a sagittal area may be distinguished by its smoother texture. The squamosal is very low, but elongate; the glenoid cavity is placed well above the level of the teeth and is small and slightly convex but with a deep fossa behind it; the postglenoid process is very small, but the prominent anterior lip of the auditory meatus answers the same purpose; the posttympanic process is quite long, but is not conspicuous, because of its close adhesion to the mastoid. The zygomatic process has about the same relative length as in *Zaëdyus*, but is rather more slender and compressed, and less extended over the jugal, which is unlike that of any recent species; its anterior portion is thin and plate-like, forming, with the zygomatic process of the maxillary, a distinct suborbital process; the posterior portion, however, rapidly contracts to a slender, rod-like shape; the dorsal margin is very concave and somewhat flared outward. Although smaller than in *Zaëdyus*, the lachrymal is quite large, and extends downward to a connection with the jugal; the foramen is small, but is conspicuously placed on the margin of the orbit.

The frontals are large and receive an hour-glass shape from the postorbital constriction; the sagittal area is continued from the parietals, but its borders soon diverge to form the rather better defined supraorbital ridges, but no postorbital process is indicated; each frontal is raised into a low eminence by the sinus, but the two are separated by a median depression; no nasal processes are formed. The nasals are very long, narrow and splint-like; actually and relatively, they are longer than those of *Zaëdyus*, but resemble them in shape, except for the slight upturning at the end seen in the recent genus, being somewhat convex in both directions; anteriorly, the nasals project a little beyond the premaxillaries and have rounded tips.

The premaxillaries are very long, forming most of the anterior end of the rostrum, and are entirely edentulous; the incisive foramen is very small and apparently not divided by a spine; the palatine processes are narrow, and are not clearly demarcated from the other part of the bone. The anterior nares are small, terminal and much less oblique than in *Dasypus*. The maxillaries, which are long and low, have their highest point just in front of the orbits, though they are much lower here than in *Zaëdyus*, thence descending gradually forward and ending abruptly at the straight, transverse premaxillary suture; the alveolar process receives a somewhat fluted appearance from the tooth-sockets; the zygomatic process is very prominent and is perforated by the small, circular infraorbital foramen; the palatine processes are long, narrow and slightly concave in both directions, widening a little posteriorly between the slightly divergent rows of teeth. The palatines form a considerable part of the hard palate, extending it for some distance behind the last tooth. As a whole, the hard palate most resembles that of *Zaëdyus*, but is considerably narrower. The pterygoids are very small and apparently have no hamular processes. In shape and position the posterior nares resemble those of *Zaëdyus*, but are relatively smaller; they are short, low and narrow, with nearly straight front border and are placed well back of the teeth.

Among existing armadillos, the mandible of *Zaëdyus* is most like that of the fossil, but with many small differences; in the fossil the horizontal ramus is long, slender and shallow, tapering anteriorly to a blunt point, and the symphysis is very short; the ascending ramus is high and narrow, with the condyle raised much above the level of the teeth; the angular process is a long hook, terminating in an upturned point and is much better developed than in the modern genera; the ventral border of the ascending ramus is sinuous, concave in front and convex behind and very different from the regular, convex curvature of *Zaëdyus;* the masseteric fossa is high and narrow, but deeper than in recent armadillos. The coronoid is slender and erect, shorter, narrower and much less recurved than in *Zaëdyus;* the sigmoid notch is broader and the condyle is smaller, but of similar transverse and concave shape.

Vertebræ, Ribs and Sternum.—In all parts of the skeleton may be observed a decided resemblance to *Zaëdyus*, more than to any other modern genus. The atlas is very like that of *Zaëdyus*, so as to require no particular description. As in the latter, the axis is fused with the third cervical, and the compound vertebra differs little from that of the recent genus; the neural spine is less produced forward over the atlas and the transverse processes are decidedly shorter and more slender and less thickened at the distal end. In the other cervicals, the only differences from those of *Zaëdyus* are the absence of a neural spine from the fourth vertebra and the shorter and more slender transverse processes of all.

Of the thoracic series, the anterior three vertebræ, and the spines of the fourth and fifth are known; the centra diminish rapidly in breadth from the first to the third, but increase in thickness, the anterior face of the first being a mere plate with convex edge; the neural spines are conspicuously shorter, more slender and less steeply inclined than in *Zaëdyus* and the transverse processes are shorter and narrower, though of similar form and similarly perforated by a vertical canal.

At least three lumbars (Plate VI, fig. 10) were present, that number being still attached to the pelvis in one individual; they also resemble the corresponding vertebræ of *Zaëdyus*, but have somewhat smaller and lighter centra, with more prominent paired ventral processes and decidedly longer transverse processes. The zygapophyses and accessory articular processes are quite as complex as in the modern genus, but the metapophyses are shorter and more slender.

Of the sacrum, only the anterior half has been recovered and this bears a close resemblance to the same part of *Zaëdyus*, except that the median ventral keel is more prominent and the fossa on each side of it correspondingly deeper.

Only one caudal vertebra, from near the hinder end of the series, has yet been found, and this indicates a stout and elongate tail. Two chevron-bones have also been obtained, one of them not unlike that attached to the second and third caudals in the recent genus, though the distal end is less expanded; it is short, broad, heavy and perforated by a canal; the other resembles the sixth chevron of the modern genus and has the canal converted into an open groove.

The ribs are so much like those of *Zaëdyus* that they require but a very brief description; the first rib has a rather more distinct and incurved neck, and the other ribs, both costal and sternal, are somewhat more slender.

The same is true of the sternum; the manubrium is relatively a little narrower than in the recent genus and the posterior part, behind the rib-facets, shorter. The xiphisternum is much more slender and less depressed; the median portion is more constricted and the hinder end broader, thinner and more spatulate.

Appendicular Skeleton.—The scapula (Plate VI, fig. 5) is, on the whole, most like that of *Dasypus* and is smaller, especially much narrower, than that of *Zaëdyus;* the coraco-scapular notch is much shallower than in the latter and even shallower than in the former, and the coracoid border is slightly raised and pursues a sinuous course, meeting the suprascapular border at nearly a right angle; the postero-superior angle of the blade is produced into a flat, sickle-shaped extension, like that of *Zaëdyus*, but very much smaller; the spine, which has a nearly median position, has a thickened and recurved free border; nothing is known of the acromion. The coracoid is a long, slender, incurved hook, like that of *Zaëdyus*, but narrower.

The humerus (Plate VI, fig. 6) closely resembles that of *Zaëdyus;* as in that genus, the bicipital groove is converted into a canal by a bony bridge, which connects the tuberosities; the deltoid ridge is immensely developed and ends distally in a broad, overhanging hook; the internal epicondyle is relatively larger than in the modern genus; the trochlea, which is very low and wide, has a prominent hemispherical convexity for the radius.

The ulna and radius (Plate VI, figs. 7, 8) are so like those of the recent genus that no description of them is required, further than to note their greater relative slenderness.

A large part of the manus (Plate VI, fig. 9) is associated with one individual of *P. exilis*, but lacks the radial side of the carpus, metacarpal I and all of digit V. The lunar is relatively large and rests principally upon the unciform. The pyramidal is short and very wide and has the usual articulation with metacarpal V; its oblique position in the carpus makes the ulnar surface almost as much lateral as proximal. The magnum is very small and the unciform proportionately large.

The metacarpals are like those of *Zaëdyus*, except in being more slender. Metacarpal II has the characteristic convex head for the trapezoid and is short and slender; metacarpal III is considerably longer and much stouter, while metacarpal IV is very short and broad and of subquadrate shape.

The phalanges are different in every digit. The proximal phalanx of digit I is extremely slender, but longer than in *Zaëdyus*, indicating that the pollex was less reduced than in the latter. In digit II the first and second phalanges are very long and slender, while the ungual is small, narrow and sharp-pointed; digit II is the longest of the series. In digit III the first and second phalanges are stout and very short, but the ungual is very large, the largest in the manus. The proximal phalanx of digit IV is extremely short, the second much longer and the ungual only slightly smaller than that of digit II. All of the unguals have a long, shallow fissure on the dorsal side near the distal end.

Of the pelvis (Plate VI, fig. 10) only the ilia are known; they are intimately united with the sacrum and diverge strongly toward the hinder end, so that the pelvic opening is much wider at the acetabulum than in front, from which it may be inferred that, as in *Zaëdyus*, there was no pubic symphysis. The peduncle of the ilium is shorter than in the recent genus, slender and trihedral in form, and the anterior expansion is also shaped as in the latter, but has a much less prominent crista; the ilio-pectineal process is very large.

The femur (Plate VI, fig. 11), while in general like that of *Zaëdyus*, differs from it in many ways; the head is small and hemispherical, is set upon a very short neck and has a large, deep pit for the ligamentum teres; the great trochanter rises much higher above the head than in the recent genus, but is not so expanded antero-posteriorly, and has a thickened free border, while the digital fossa is almost obsolete; the second trochanter is like that of *Zaëdyus*, but is narrower, while the third is more prominent, but narrower, and has a rather more proximal position. The shaft is more slender and more cylindrical and the ridge which passes down its external side from the third trochanter ends distally in a more prominent process; the conical tubercle just above the internal condyle is more definite; the rotular groove is shorter and the inner condyle is larger.

The patella resembles that of *Zaëdyus*, but is thinner and less rugose.

The tibia (Plate VI, fig. 12) is proportionately longer and more slender than in the existing genus and is much narrower at the distal end. On the other hand, the fibula is somewhat heavier and much straighter, making the arcade between the bones narrower.

Of the pes (Plate VI, fig. 18) we have the tarsus complete, and all the metatarsals, except metatarsal V, but without phalanges. As in all other parts of the skeleton, there is close resemblance to *Zaëdyus*, with a number of minor differences. The astragalus is relatively narrower and has a more elongate, slender and less depressed neck. In the calcaneum, the tuber is somewhat longer and heavier, with more expanded and club-like proximal end, which has a shallower tendinal sulcus; the external tubercle near the distal end for the attachment of the lateral ligament is less prominent. The accessory, spur-like ossicle, which is so conspicuous in the recent genus, was doubtless present in the fossil, as is indicated by the prominent tubercle which arises from the inner side of the navicular and bears a distinct facet. The ento-cuneiform has a more quadrate shape than in the modern animal, its proximal end not being truncated, which is an indication that the accessory ossicle had a different shape. The meso- and ecto-cuneiforms differ in no tangible fashion from those of *Zaëdyus.* Metatarsal I is somewhat longer than in the latter, while metatarsal II is proportionately more slender, as is also metatarsal III, which is the longest of the series, metatarsal IV being of nearly the same length as II.

Taxonomic Position.—From the foregoing description, it will be sufficiently clear that this genus is very closely allied to the recent *Zaëdyus*, for all parts of the skeleton show the closest correspondence between them, with differences of only very minor importance. Systematically, the only difference of generic value is in the carapace, which in the fossil has no scapular buckler, but, except in the hinder part, is formed of movable, imbricating bands. There seems to be no reason to doubt that *Prozaëdius* is well named, as being the ancestor of *Zaëdyus.* Aside from the rodents, no other instance is known of so close and direct a connection between a recent genus and one of Santa Cruz times.

PROZAËDIUS EXILIS Ameghino.

(Plate VI, figs. 1–14.)

Euphractus exilis Amegh.; Enumeracion sistematica, etc., 1887, p. 26.
Zaëdyus exilis Amegh.; Contrib. al Conoc. de Mam. Fos. de la Repúb. Argent., 1889, p. 868.
Prozaëdius exilis Amegh.; Rev. Arg. de Hist. Nat., T. I, 1891, p. 327.
Dasypus exilis Lydekker; Anales del Museo de La Plata, T. III, 1894, p. 62.

This, the smallest known species, is much inferior to the exisiting *Zaëdyus ciliatus* in size. The carapace has no marked differences from that of the other species, *P. proximus*, except that it is smaller, and in most of the movable plates the two lateral longitudinal ridges are rather more distinctly divided by transverse grooves into tubercles, but the difference is slight and perhaps not constant. A plate of the posterior movable band measures 15x4 mm., and one of the first fixed row 8x6 mm.

The dental formula is $\frac{7-8}{10}$. In the upper jaw, $^{\underline{1}}$ is very small, but the successive teeth gradually become larger to the antepenultimate, the penultimate is somewhat smaller and the last tooth is quite small and of cylindrical form, not of oval section, as are most of the others. In the lower jaw, $_{\overline{1}}$ is very small, laterally compressed and almost laminar; $_{\overline{2}}$, $_{\overline{3}}$ and $_{\overline{4}}$ are of similar form, but successively larger; from $_{\overline{5}}$ to $_{\overline{9}}$ the teeth are much thicker and have bevelled crowns; $_{\overline{7}}$ and $_{\overline{8}}$ are the largest of the series and $_{\overline{10}}$ is quite small.

The skull has a short, broad and low cranium and a slender, tapering rostrum. The horizontal ramus of the mandible is very slender and in the symphyseal region tapers to a comparatively sharp point, with relatively long and slightly decurved edentulous portion; there are two mental foramina, each opening laterally; the ascending ramus has a backward inclination and the angular process is long and prominent.

The following measurements are taken from a single individual (No. 15,579).

MEASUREMENTS.

Upper dentition, length	.019	Axis and third cervical, length	.009
Lower " "	.027	Neck, length	.029
Skull, length on median basal line	.055	First thoracic, length of centrum	.004
" extreme length	.066	" " width of anterior face	.014
Cranium, length to anterior rim of orbit	.028	" " " " posterior face	.012
Occiput, height	.0195	Lumbars, length of last three centra	.021
" width at base	.030	Scapula, height	.033
Palate, length	.038	" greatest width	.030
Rostrum, width at anterior end	.008	Humerus, length	.038
Mandible, length	.049	" width of proximal end	.012
" " of edentulous part	.006	" " " distal end	.017
" depth below $_{\overline{6}}$	.004	Ulna, length	.041
" thickness below $_{\overline{6}}$	.003	" " of olecranon	.015
" height of condyle	.0175	Radius, length	.025
Atlas, width	.018	" width of proximal end	.006
Axis, width of anterior face	.015	" " " distal end	.007

MEASUREMENTS.

Metacarpal II, length	.012	Pelvic opening, width at first sacral	.013
" " width of proximal end	.003	" " " " acetabulum	.025
Metacarpal III, length	.0145	Femur, length from great trochanter	.0425
" " width of proximal end	.0045	" width of proximal end	.015
Metacarpal IV, length	.007	" " " distal end	.011
" " width of proximal end	.004	Patella, length	.009
Digit II, length	.039	" width	.005
" III, "	.037	Tibia, length	.040
" IV, "	.028	" width of proximal end	.011
Ungual phalanx ,digit II, length	.010	" " " distal end	.008
" " " III, "	.015	Fibula, length	.038
" " " IV, "	.014	" width of proximal end	.002
Ilium, length	.036	" " " distal end	.005

PROZAËDIUS PROXIMUS Ameghino.

(Plates V; VI, figs. 15–18.)

Euphractus proximus Amegh.; Enumeracion sistematica, etc., 1887, p. 26.
Zaëdyus proximus Amegh.; Contrib. al Conoc. de Mam. Fos., etc., 1889, p. 867.
Prozaëdius proximus Amegh.; Rev. Arg. de Hist. Nat., T. I, 1891, p. 327.
Dasypus proximus Lydekker; Anales del Museo de La Plata, T. III, 1894, p. 61.

The nearly complete carapace figured on Plate V seems to be referable to this species. It represents a somewhat larger animal than *P. exilis* and the markings of the scutes differ slightly, those of the movable bands having a somewhat broader median longitudinal ridge, giving the plate a rather more fluted appearance. This particular individual has three glandular openings in the median line of the pelvic buckler, one in each of the first three fixed rows; the openings are bilobate, more or less completely divided into two foramina, and the plates are perforated by them. In *Dasypus septemcinctus* the openings are similar, but occupy a more posterior position; namely, in the third, fourth and fifth rows. The following dimensions are taken from No. 15,237, an isolated carapace.

MEASUREMENTS.

Carapace, estimated length	.183	Scute of tenth band, width	.0055
" greatest width	.140	Scute of first fixed row, length	.009
Scute of tenth band, length	.020	" " " " " width	.006

The dental formula is $\frac{8}{10}$ and the anterior upper teeth, though of similar form to those of *P. exilis* are distinctly larger; the same is true of the lower teeth, the crowns of which do not protrude so much above the alveoli as in the preceding species.

The skull is of very similar appearance to that of *P. exilis* and the difference in size is trifling, but there are some not unimportant differences of proportions. The cranium is more vaulted and rises higher above the occipital crest; the constriction in front of the orbits is more gradual, and the rostrum longer and more tapering. The basioccipital is rather more distinctly keeled in the median ventral line and its posterior border is much more deeply notched, giving to the narrower foramen magnum quite a different shape. The mandible displays a number of characteristic differences; the horizontal ramus is stouter, straighter, with a less sinuous ventral border, and ending anteriorly in a much blunter point; the edentulous part is a little shorter and much less decurved. In addition to the two mental foramina seen in *P. exilis*, there is a third, which opens on the ventral side of the ramus, on the same transverse line as the anterior of the two lateral foramina. The ascending ramus is more erect, less inclined backward than in the other species, the angular process shorter and decidedly less elevated above the level of the horizontal ramus, and the condyle larger.

In the subjoined table the measurements are taken from No. 15,567.

MEASUREMENTS.

Upper dentition, length	.023	Astragalus, width of distal end	.0035
Lower " "	.027	Calcaneum, length	.013
Skull, length in median basal line	.056	" " of tuber	.009
" greatest length	.070	" width of distal end	.004
Cranium, length to anterior rim of orbit	.031	Metatarsal I, length	.009
Occiput, height	.021	" " width of proximal end	.0035
" width at base	.029	" " " of distal end	.002
Palate, length	.036	Metatarsal II, length	.015
Rostrum, width of anterior end	.007	" " width of proximal end	.004
Mandible, length	.051	" " " of distal end	.0035
" " of edentulous part	.0053	Metatarsal III, length	.016
" depth below $_{\overline{8}}$	.005	" " width of proximal end	.004
" thickness below $_{\overline{8}}$	.004	" " " of distal end	.004
" height of condyle	.0185	Metatarsal IV, length	.014
Astragalus, length	.008	" " width of proximal end	.003
" width of trochlea	.006	" " " of distal end	.0035

STENOTATUS Ameghino.

(Plates VI, figs. 19–26; VII, 1–3.)

Euphractus Amegh., in part; Enumeracion sistematica, etc., 1887, p. 26.

Dasypus Amegh., in part; Contrib. al Conoc. de los Mam. Fos., etc., 1889, p. 864.

Stenotatus Amegh.; Rev. Arg. de Hist. Nat., T. I, 1891, p. 253.

Dasypus Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 55.

Prodasypus Amegh.; Énum. Synopt. d. Mamm. Foss. de Patagonie, 1894, p. 172.

This genus is closely allied to *Prozaëdius*, but is, nevertheless, clearly distinguished from it by differences which appear in all parts of the exo- and endoskeleton.

Exoskeleton.—The cephalic shield (Plate VI, fig. 19), like that of the preceding genus, is composed of small, thin, polygonal plates, which are of irregular size and shape and are pitted all over the exposed surface; they differ in being more coarsely marked and thicker and in having their angles more rounded.

In the carapace (Plate VII, figs. 1–3) the scutes differ from those of *Prozaëdius* in being larger and very much thicker. The sculpture is of the same general pattern, but with obvious differences; the plates of the movable bands have the three longitudinal ridges, but they are of nearly equal width and prominence and the lateral ridges are entire, showing hardly any tendency to break up into rows of tubercles, while the median ridge often dies away before reaching the hinder margin of the plate; the piliferous holes are much better developed, especially in *S. hesternus*, in which they are very conspicuous; the marginal scutes are smooth and coarsely pitted.

The pelvic shield consists of eleven rows of plates and those of the terminal row are drawn out into long, blunt spines, like those of the recent *Zaëdyus*, but differently marked. The plates of the pelvic shield are relatively shorter and broader than in *Prozaëdius* and have a somewhat different ornamentation, in that the median ridge does not reach the hinder border of the plate (except in the last three rows), but becomes confluent with the raised posterior margin, thus forming an inverted **T**, while the lateral and anterior tubercles are larger and less numerous (four or five instead of eight or nine).

Dentition.—I have seen no specimen in which the number of upper teeth could be definitely determined, but the dental formula would appear to be $\frac{9}{10}$ and, so far as I can judge, no tooth is implanted in the premaxillary. In the upper jaw the two dental series converge anteriorly; $^{\underline{1}}$ is very small, compressed, and almost laminar; it is separated from $^{\underline{2}}$ by a considerable diastema, which is a marked distinction from *Prozaëdius;* $^{\underline{2}}$ is somewhat larger and is separated from $^{\underline{3}}$ by a diastema which is about one-half as long as that between $^{\underline{1}}$ and $^{\underline{2}}$; the remaining teeth follow with the usual regular interspaces, increasing in size, especially in thickness, to $^{\underline{7}}$, while $^{\underline{8}}$ and $^{\underline{9}}$ are slightly smaller; most of them are of oval section and bevelled by wear, with a central area of harder dentine.

In the mandible the first four teeth are more widely spaced than the last six, but there is no such diastema as in the upper jaw. These anterior teeth are very much compressed and thin, while the succeeding teeth increase in size to $_{\overline{10}}$, which is the largest of the series.

Skull (Plate VI, fig. 20).—The skull is remarkable for its extreme elongation, especially of the rostrum, while the cranium is not much larger than that of *Prozaëdius*, which it closely resembles. Unfortunately the only available specimen is much mutilated, so that many of its features are quite indeterminable. The cranium is short, broad and low; the parietal eminence is but slightly higher than the occipital crest, and thence the upper profile descends very gradually to the end of the long rostrum.

The occiput is low and very broad and has a moderately prominent crest, the median dorsal portion of which is curved forward between the parietals more abruptly and farther than in *Prozaëdius.* The basioccipital is broad, narrowing forward, with a median keel and shallow lateral fossæ; the condyles are much as in the latter genus, but the external sulcus is far better defined. No sagittal crest is present and the sagittal area is even more obscurely indicated than in *Prozaëdius.* The glenoid cavity differs from that of the latter in being narrower, more elongate and of more oval shape. The frontals are marked by a postorbital constriction, which is shallower and less abrupt than in the preceding genus, and by an unusual preorbital extension; apparently, the frontal sinuses produce hardly any convexity of the forehead. The nasals are narrow and remarkably long; anteriorly, they broaden somewhat, are bluntly pointed and project well beyond the premaxillæ, making the narial opening very oblique. The premaxillaries are elongate and form most of the anterior portion of the rostrum, curving far over upon the dorsal side. The maxillaries are exceeding long and low, forming much the greater part of the rostrum, upon the dorsal side of which they are reflected. Enough remains of the palate to show that it is very long and remarkably narrow, broadening slightly behind.

The mandible is quite peculiar; the horizontal ramus is rather shallow and for most of its length thick and stout, but becoming very much compressed, thin and plate-like in the anterior part, where it is very different from the slender and tapering ramus of *Prozaëdius*, one of the most constant and characteristic differences between the two genera. Two mental foramina are present, of which the anterior one is very large and deep and is placed below $_{\overline{2}}$, while the posterior one is very much smaller and opens below $_{\overline{3}}$. The ventral border of the jaw is straighter than in the last named genus, but rises more and is more concave below the ascending ramus, which is more steeply inclined; the condyle is large and concave.

Vertebræ, Ribs and Sternum.—Of the vertebral column are preserved the cervical and five thoracic vertebræ of one individual, three lumbars, most of the sacrum and a few scattered caudals of another. The atlas differs from that of *Prozaëdius* only in size, but the axis is coössified with both third and fourth cervicals, instead of with the third only; the fifth, sixth and seventh are relatively longer and have stouter neural arches.

The thoracic vertebræ exhibit no features that call for description, while the lumbars and sacrals (Plate VI, fig. 25) hardly differ from those of *Prozaëdius* except in size; however, it may be noted that the ends of the lumbar metapophyses are expanded antero-posteriorly in an unusual degree. The caudals, which are in an unsatisfactory state of preservation, indicate a long and stout tail.

No exact comparison of the ribs with those of *Prozaëdius* can be made, but in the present genus they appear to be relatively broader. The manubrium sterni is like that of the former, but with much more prominent ventral keel, and with more elongate extension behind the processes for the first pair of ribs.

Appendicular Skeleton.—A fragment of the distal end of the scapula is remarkable for the great development of the posterior ridge, which is comparable to the true spine in prominence and is quite distinct from the glenoid border. The coracoid differs from that of *Prozaëdius* in being shorter, broader and bifid at the end.

The humerus (Plate VI, fig. 21) differs from that of *Zaëdyus* and *Prozaëdius* in only a few respects; the head is longer, narrower and more convex, the tuberosities are more widely separated and the bicipital groove is open, not a canal; the shaft is longer and more slender and the deltoid ridge does not project so much externally; on the trochlea, the groove external to the convexity for the head of the radius is deeper and its outer flange more prominent.

The ulna (Plate VI, fig. 22) is very like that of *Prozaëdius*, but is distinguished not only by its larger size, but also by its more pronounced sigmoid curvature, the greater breadth of the anterior border of the olecranon, the greater length and less breadth of the sigmoid notch, the thin plate-like character of the shaft and the slight expansion of the distal end.

The radius (Plate VI, fig. 23) has a broader head than in the preceding genus and the articular surface is more distinctly divided into two facets, of which the external is much larger; the distal end is quite the same, except that the division between the two carpal facets is much less distinct; the proximal portion of the shaft is extremely slender.

The manus (Plate VI, fig. 24) displays some of the most characteristic features of the present genus. In most respects, the carpus is like that of *Dasypus*, but it has certain peculiarities. The proximal portion of the scaphoid is much extended palmo-dorsally and projects out above the trapezoid in a great, spur-like process. The lunar has a more strongly convex surface for the radius, which is reflected farther upon the dorsal side than that of *Prozaëdius*. In the pyramidal the only noteworthy difference from the latter genus is in the shape of the ulnar facet, which has not the deep concavity near the external end. The pisiform resembles that of *Dasypus*, but is more elongate, slender, incurved and tapering. The trapezium is not known and the trapezoid requires no description, except to mention its somewhat unusually extensive articulation with metacarpal III, while the magnum is relatively much larger than in *Prozaëdius*. The unciform is quite as in the latter, but is somewhat longer in proportion to its breadth, and its distal face is more deeply notched for the narrow, convex head of metacarpal IV.

The metacarpus consisted of five members, though metacarpal I has not yet been found. Metacarpal II is elongate and quite slender and its distal trochlea has a much deeper median groove than that of *Prozaëdius*. Metacarpal III is much longer and stouter, with very deep proximal concavity for the magnum and unusually deep pit on the ulnar side for the projection from metacarpal IV; the distal trochlea is not so much grooved as that of metacarpal IV, but proximal to the trochlea on the dorsal side of the shaft is a large, deep fossa, which receives the "beak" of the first phalanx. Metacarpal IV is hardly more than one half as long as metacarpal III; its proximal end is extensively overlapped by the latter, so that only a narrow convexity articulates with the unciform, quite as in *Dasypus;* this convexity has a more external position than in *Prozaëdius*, giving the proximal end a bifid appearance, instead of the trifid shape seen in the latter. Metacarpal V is extremely short, heavy and of pyramidal shape, less quadrate than that of *Dasypus*, but otherwise like it.

The phalanges differ in certain respects from those of any other Santa Cruz armadillo. The proximal phalanx of the pollex is long and slender, like that of *Prozaëdius;* in digit II the same phalanx is very long, almost equalling metacarpal II in length; it is very slender and compressed, though quite heavy at the proximal end, and the distal end is much more deeply grooved than in the preceding genus. The second phalanx of this digit is like the first, but even longer and more compressed, a marked difference from *Prozaëdius*. The ungual is rather small, of symmetrical shape, slender, decurved and pointed; it is not cleft at the tip and has an uncommonly large subungual process. Despite its small ungual, digit II slightly exceeds III in length.

In digit III the first and second phalanges are coössified, the only instance of the kind yet observed among the Santa Cruz edentates. A suture yet remains to show that the first is very short, while the second is longer, though hardly half as long as the corresponding phalanx of digit II. The ungual is much the largest in the manus and its great length almost compensates for the shortness of the other two phalanges; in shape it is unlike that of any other known contemporary armadillo, being narrow, moderately decurved, bluntly pointed and quite asymmetrical; the ulnar side is convex and curves gradually into the dorsal surface, while the radial side is plane and forms a sharp border along its junction with the dorsal side; the end is uncleft and the subungual process large.

In digit IV the phalanges are like those of digit III, but they are all free and are shorter, especially the proximal one; the difference in size between the unguals of digits III and IV is much greater than in *Prozaëdius*. Digit V has still shorter phalanges of similar shape.

The comparative length of the digits is in the following order: II, III, IV, ?I, V; the greater length of II is entirely owing to the elongation of the first and second phalanges, while in III it is due to the metacarpal and the great size of the ungual. In digit IV the reduction of the metacarpal shortens the whole digit, while in V all the elements, except the claw, are much shortened.

As a whole, the proportions of this manus distinctly resemble those of *Cabassous* (*Xenurus*); it is of a decidedly more advanced and specialized type than the manus of *Dasypus*.

Though of the same general plan, the pelvis (Plate VI, fig. 26) differs considerably from that of *Prozaëdius;* the ilia do not diverge posteriorly, but pursue a nearly parallel course; they are narrow, trihedral and only moderately thickened and everted at the anterior end, where they extend beyond the sacrum; the peduncle is short, broad and depressed, with prominent borders and nearly flat iliac surface. A great difference from the preceding genus is the formation of a pubic symphysis, sufficient of the broad, stout pubes remaining to demonstrate this. The ischia are unknown.

The femur (Plate VI, fig. 26), of which only the proximal half is known, is quite unlike that of *Prozaëdius* and resembles more the peculiar femur of *Proeutatus;* the head is quite small and almost sessile and has a very large fossa for the round ligament; the great trochanter is relatively enormous, far larger than in the preceding genus, rising far above the head, and, though laterally compressed and only moderately expanded at the free end, has yet a large antero-posterior extension, which increases proximally; the anterior border is extended well down the shaft as a prominent ridge, while the posterior border continues to the second trochanter as an intertrochanteric line; there is no distinct digital fossa, but a depression behind and below the head; the second trochanter is also very large, arising immediately below the head, and of the usual form; the third trochanter is a very narrow, but very prominent antroverted hook.

So much of the shaft as is preserved differs markedly from that of *Proeutatus*, not being antero-posteriorly compressed and flattened, but slender and trihedral, with large, thin-walled medullary cavity.

Of the pes, only metatarsal III is preserved and this differs from that of *Prozaëdius* merely in size and in its greater length as compared with that of metacarpal III.

STENOTATUS PATAGONICUS (Ameghino).

(Plates VI, figs. 19–25; VII, figs. 1, 2.)

Euphractus patagonicus Amegh.; Enum. sistemat., etc., 1887, p. 26.

Dasypus patagonicus Amegh.; Contr. al Conoc. de Mam. Fos. de la Rep. Arg., 1889, p. 866.

Stenotatus karaikensis Amegh.; Rev. Arg. de Hist. Nat., T. I, 1891, p. 253.

Prodasypus patagonicus Amegh.; Énum. synopt. d. Mam. Fos. de Patagonie, 1894, p. 173.

Dasypus patagonicus Lydekker; Anales del Mus. de La Plata, T. III, 1894, p. 60.

This species is distinguished especially by the plates of the carapace, which in the movable bands are ornamented by three subequal longitudinal ridges; in each of the grooves demarcating the median ridge are three or four small and inconspicuous piliferous pits.

As the skull, teeth and skeleton are known only in this species, the account of them in the generic description has been drawn entirely from it and it remains only to give the measurements, which are taken from two individuals (Nos. 15,563 and 15,863), collected by Messrs. Hatcher and Peterson at Killik Aike. From the former are taken the dimensions of the fixed scutes, and of the lumbar vertebræ, sacrum, pelvis femur and metatarsal III, all the others from the latter.

MEASUREMENTS.

Scute of (?) second movable band, length	.0135
" " " " " width	.006
" " (?) eighth " " length	.023
" " " " " width	.0065
Scute of second row, pelvic buckler, length	.012
Scute of second row, pelvic buckler, width	.0075
Upper dentition, length	.042
Diastema between $^{\underline{1}}$ and $^{\underline{2}}$	.004
Lower dentition, length	.041
Length $_{\overline{6}}$ to $_{\overline{10}}$ inclusive	.021
Skull, length in median basal line	.080
" greatest length	.097
Cranium, length to anterior rim of orbit	.041
Face, length	.056
Occiput, height	.023
" width at base	.035
Rostrum, width at anterior end (ca.)	.010
" " " $^{\underline{4}}$	.016
Neck, length	.047
Axis, width of centrum	.0185
Compound cervical, length	.020

Fifth cervical, length of centrum	.0045
Seventh cervical, length of centrum	.006
Thoracic vertebræ one to five, length	.040
Lumbars, last three, length	.031
Scapula, antero-posterior diameter glenoid cavity	.010
Sacrum, length	.073
Ilium, length	.055
Pelvis, width at first sacral vertebra	.017
“ “ at acetabulum	.032
Humerus, length	.0555
“ width of proximal end	.0105
“ “ of distal end	.021
Ulna, length	.069
“ “ of olecranon	.022
Radius, length	.038
“ width of proximal end	.008
“ “ of distal end	.009
Metacarpal II, length	.011
“ “ width of proximal end	.004
“ “ “ of distal end	.005
Metacarpal III, length	.019
“ “ width of proximal end	.0065
“ “ “ of distal end	.0055
Metacarpal IV, length	.009
Metacarpal IV, width of proximal end	.006
Metacarpal V, length	.0045
“ “ width of proximal end	.004
Digit II, length	.055
“ III, “	.050
“ IV, “	.038
“ V, “	.024
Digit II, first phalanx, length	.013
“ “ second “ “	.013
“ “ third “ “	.0145
Digit III, first phalanx, length	.005
“ “ second “ “	.008
“ “ third “ “	.021
Digit IV, first phalanx, length	.003
“ “ second “ “	.0075
“ “ third “ “	.019
Digit V, first phalanx, length	.002
“ “ second “ “	.006
“ “ third “ “	.012
Femur, width of proximal end	.018
“ “ over third trochanter	.020
Metatarsal III, length	.023
“ “ width of proximal end	.006
“ “ “ of distal end	.0045

STENOTATUS HESTERNUS (Ameghino).

(Plate VII, fig. 3.)

Dasypus hesternus Amegh.; Contrib. al Conoc. de los Mam. Fos. de Rep. Arg., 1889, p. 922.

Prodasypus hesternus Amegh.; Énum. synopt. d. Mam. Fos. de Patagonie, 1894, p. 173.

Prodasypus externus Amegh.; Secundo Censo de la Rep. Arg., T. I, 1898, p. 218.

This species, which is not represented in the Princeton collection and is known only from parts of the carapace, may be distinguished by the scutes of the movable bands; these have three or four very large and conspicuous pits in each of the longitudinal grooves; several smaller pits are placed transversely near the anterior border of the exposed part of the plate.

PELTEPHILIDÆ Ameghino.

PELTEPHILUS Ameghino.

(Plate XVI.)

Peltephilus Amegh.; Enumeracion sistematica, etc., 1887, p. 25.
Cochlops Amegh., in part; Contribucion al Conoc. de los Mam. Fos. de la Rep. Arg., 1889, p. 792.
Gephyranodus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 119.
?*Anantiosodon* Amegh., Ibid., p. 327.

This extraordinary genus is one of the most curious of Santa Cruz mammals and, although containing several species, is comparatively rare among the fossils. Almost all parts of the skeleton are now well known and show that these animals were unmistakable armadillos and yet, in many respects, extremely aberrant.

Exoskeleton. — Not the least peculiarity of the genus is the remarkable cephalic shield (Plate XVI, figs. 2, 6, 7), which is utterly unlike that of any other known armadillo. In *P. ferox* and, doubtless, in the other species also, the shield consists of nineteen or twenty-one large and heavy plates of bone, arranged to form a definite pattern. In the median line and extending from the occipital crest to the anterior edge of the orbit, are three symmetrical, unpaired plates, of which the posterior is the largest of the entire shield and has a somewhat irregularly hexagonal shape. In its shape and proportions, this posterior median plate differs considerably in the different species, but appears to be constant in each species. The second median plate is longer and much narrower and the anterior one much smaller. On each side of the median series are seven plates of varying sizes and shapes, but all polygonal except the postorbital, which curves downward almost to the zygomatic arch and ends in a blunt point. Most remarkable of all is the pair of plates which are situated on the nasals and maxillaries and have subquadrate bases, rising into high, sharp-pointed, slightly incurved and recurved horns. Ameghino believes ('94*a*, 177) that a second pair of horn-like scutes is placed on the nasals in front of the principal pair, but I have not been able to satisfy myself entirely that this is true. All the plates of the head shield have a very rugose surface; the markings appear to be constant for each species.

As yet, no considerable part of the carapace has been found, but great numbers of separate scutes have been collected, all of which are extremely characteristic. In the movable bands (Plate XVI, fig. 8) the plates are of very different sizes, but are always remarkably broad in proportion to their length, and some of them are almost square; they are quite thin and, when viewed from the side, have usually a more or less distinct sigmoid curvature; the part of each plate which was overlapped by the preceding one is remarkably short, shorter than in any other known genus, except some of the anterior plates of *Stegotherium;* in the exposed part of the scute are two or three very large and conspicuous pits which were doubtless for the insertion of tufts of hair, or bristles; on some of the plates three longitudinal ridges are feebly marked, others show no trace of them; the surface of the scutes is everywhere coarsely pitted and on the margins are large and probably piliferous pits. The fixed scutes are smaller and thinner than the movable ones, but, except that no part is covered, they resemble the latter in markings and in the presence of the large pits; these plates appear not to have united with one another suturally, but merely to have been in juxtaposition. According to Ameghino ('94*a*, 175) a tail-sheath was present.

Dentition. — The teeth are hardly less peculiar than the head-shield. The dental formula is $\frac{7}{7}$ and in both jaws the teeth form a continuous series in a well-defined arch. No diastema is present, but each tooth is isolated by very short spaces, and all the teeth have an external layer of hard and polished dentine, suggesting enamel in appearance. None of the specimens that I have examined shows the suture between maxillary and premaxillary very distinctly, but it would seem that only one tooth was implanted in the latter. When the jaws are closed, the anterior upper teeth pass outside of the lower ones and conceal them from view. The first upper tooth, $^{\underline{1}}$, presents directly forward and has a strongly convex anterior face and almost plane posterior face; the crown is somewhat chisel-shaped, but narrows distally, ending in a blunt point: $^{\underline{2}}$ is considerably larger and is usually the highest and most prominent tooth in the series, it is of triangular section, with the rounded apex turned forward and with a shallow, vertical groove on the outer face near the posterior border; the hinder surface is obliquely worn, making the tooth quite sharply pointed: $^{\underline{3}}$ is generally lower than $^{\underline{2}}$, but of somewhat greater diameter and more deeply grooved on the outer face; it is almost as sharp-pointed: $^{\underline{4}}$ is similar, but smaller and blunter: $^{\underline{5}}$ is still smaller and the end is bevelled by wear: $^{\underline{6}}$ is much smaller and has a nearly horizontal grinding surface: $^{\underline{7}}$ is extremely small and cylindrical.

In the lower jaw, $_1$ is extremely small; the succeeding teeth increase in size to $_5$, which is the largest of the series, and thence diminish to $_7$; the lower teeth resemble the upper in form, but the principal grinding surface is anterior.

Skull (Plate XVI, figs. 1–5).—In striking contrast to that of all other known Santa Cruz armadillos, the skull is short, broad and heavy, with very short and wide rostrum; the occiput is rather low, the cranium long, broad and quite capacious, its upper contour rising gently from the occipital crest to the parietal eminence, which is not conspicuous and is placed unusually far forward; the profile descends steeply at the forehead and is almost straight along the short rostrum; the postorbital constriction is shallow and there is no great expansion in front of it. The base of the cranium is but slightly elevated and the occipital condyles project below the level of the teeth. The occiput is broad, of subquadrate shape, narrowing a little dorsally; the crest is thick and rugose, but not very prominent and the occipital surface is, for the most part, simply convex, without marked elevations or depressions, except for a narrow groove near each infero-lateral angle; no paroccipital process is apparent; the foramen magnum is relatively small and transversely oval; the condyles are small, of more oval and less cylindrical shape than in any of the preceding genera; they are even more sessile and the articular surface is not invaded by a sulcus from the outer side, as it is in all of the other contemporary genera of armadillos.

The basicranial axis is uncommonly long in proportion to the length of the skull; the basioccipital, which is long and broad, has a nearly plane ventral surface, except posteriorly, where it is flared to form a prominent lip for the foramen magnum; the basisphenoid is of similar form, but somewhat narrower. The tympanic differs from that of the other Santa Cruz armadillos in forming a large, inflated and fully ossified bulla, which is firmly connected with the surrounding bones and is relatively quite as large as in *Dasypus;* the external meatus is not so long as in the recent genus and is a tube, the tympanic portion of which is incomplete, the dorsal wall being formed by the zygomatic process and the anterior by the postglenoid process, which is concave behind and very closely applied to the tympanic. Owing to this intimate connection, to the very low origin of the zygomatic process upon the side of the cranium and to the unusually anterior position of the opening, the meatus has the remarkable peculiarity of seeming to perforate the zygomatic arch, in a manner that does not occur in any other known armadillo. The mastoid appears to be quite extensively exposed on the occipital surface, ending in a large and bulbous, but not prominent mastoid process, which is separated from the posttympanic by a deep notch.

The parietals are very large, forming nearly the entire roof of the cerebral fossa and extending to the postorbital constriction; a sagittal crest is present, but differs much in development in the various species. The squamosal is long and low and its surface is roughened by pits and by several conspicuous vascular foramina; the glenoid cavity is unlike that of any other contemporary armadillo in being a clearly defined, broad and shallow fossa, which is placed very low down upon the side of the cranium; the posttympanic process is very small. As Ameghino has pointed out ('94*a*, 175), there appears to be a suture between the squamosal proper and the zygomatic process, which he regards as the homologue of the quadrate; but the relation is far from clear. The zygomatic process is short, slender, laterally compressed and almost straight; it does not, as in other armadillos, curve downward, but is nearly horizontal, or even slightly upturned. The jugal is quite elongate, slender, compressed and somewhat curved and extends forward to a contact with the lachrymal; at the posterior end is a feebly marked postorbital process. Alone among known Santa Cruz edentates, *Peltephilus* has no suborbital process from the zygomatic arch.

The lachrymal is quite a large bone, extending upon the face to a contact with the nasal; the foramen is small and placed within the rim of the orbit. The frontals are shorter than the parietals and gradually expand anteriorly over the orbits, with very short postorbital processes, below each of which is a small vascular foramen; the forehead descends quite steeply forward and displays but a slight indication of sinuses in the form of two very inconspicuous and widely separated swellings; the nasal suture is concave, but there are no nasal processes; on the sides of the skull, the frontals descend to reach the squamosals, ali- and orbito-sphenoids, and in the hinder part of each orbit is a ridge on the frontal, which partly encloses and conceals the optic foramen and the foramen lacerum anterius.

The nasals are short and broad and are therefore in striking contrast to the long, narrow and splint-like bones of other Santa Cruz genera; doubtless in correlation with the horn-like scutes which they support, these nasals are quite unusually thick and stout; at the anterior end, they extend somewhat beyond the premaxillæ, are broadened and gently decurved. The premaxillaries are small, but the ascending ramus has its dorsal end considerably produced forward in a semicylindrical process; the alveolar portion is quite high and thick, presenting forward, with a median spine-like projection; the palatine processes are exceedingly small and no distinct incisive foramen is visible. The anterior nares are large, terminal and cordiform, broad dorsally, contracting much ventrally.

The maxillary is much shorter than in other Santa Cruz armadillos and its facial portion, which is of more uniform dorso-ventral height, is made convex by the sockets of the teeth, especially of $^{\underline{3}}$ and $^{\underline{4}}$; the zygomatic process is a prominent and heavy plate, with flat side directed forward; the infraorbital canal is very short and has an inferior position; the alveolar process is high and projects well below the level of the hard palate, which is thus vaulted and concave in both directions and its general shape is that of an elongate horse-shoe, contracting behind. The palatines are large and contribute extensively to the formation of the hard palate, reaching forward to the line of $^{\underline{6}}$ and, posteriorly, far behind the teeth; the margins, both in the maxillary and palatine regions, are perforated by numerous small vascular foramina. The posterior nares are small, and very low, and are placed unusually far back, not only with reference to the short dental series, but also in relation to the orbit and other parts of the skull. The pterygoids are small, without fossæ, or hamular processes.

One of the most peculiar parts of this remarkable skull is the mandible, the two rami of which are completely coössified at the symphysis, and the short, curved jaw, in a single piece, has considerable resemblance to that of a turtle. The horizontal ramus is short, incurved anteriorly to meet its fellow of the opposite side, compressed, but deep vertically; the symphysis is very short and steeply inclined and the chin abruptly rounded; the ascending ramus is very low, but with large well-defined masseteric fossa; the condyle is almost sessile and has a very inferior position, in some cases even below the level of the teeth, a very decided difference from all other Santa Cruz armadillos, except *Stegotherium;* the angular process is a short, blunt hook.

The cranial foramina are not especially peculiar; the optic foramen and foramen lacerum anterius are enclosed in a common deep depression of the orbit, then after a long interval comes an opening which doubtless represents the combined foramina rotundum and ovale, which is unusually far back, internal to the glenoid cavity and very near the foramen lacerum medium; the foramen lacerum posterius is quite large, the condylar and stylo-mastoid foramina small; no glenoid foramen is apparent.

Vertebræ, Ribs and Sternum.—The vertebral column is still incompletely known, though in the La Plata Museum is the nearly entire neck of one species, perhaps *P. pumilus*, and in the Princeton collection is an individual (No. 15,390) probably referable to *P. strepens*, which has fragmentary vertebræ from all regions of the column, and none of these displays any significant differences from those of any other contemporary armadillo. As a whole, the neck is relatively more elongate than in other Santa Cruz genera. The atlas is hardly so short as in the latter, and the transverse processes do not rise so high above the neural arch as in *Proeutatus.* In the young animal all of the cervical vertebræ are free, but in the adult the axis is fused with the third and fourth vertebræ; the axis proper has a short and very wide centrum, with large, widely separated and nearly plane surfaces for the atlas, a massive neural arch and small, subcircular neural canal, but no transverse processes; the odontoid process is heavy and bluntly conical. The compound vertebra of the adult has long and depressed transverse processes, a remarkably high, hatchet-shaped neural spine, which posteriorly extends over the neural arch of the fifth cervical. The fifth and sixth vertebræ have very short, wide centra, but the neural arches are broad and in striking contrast to the slender, thread-like arches of *Proeutatus.*

In the anterior thoracic region, the vertebræ have short, broad, depressed and slightly opisthocœlous centra, very prominent transverse processes and very long, tapering and slender neural spines. So far as can be judged from their broken condition, the posterior thoracic and lumbar vertebræ have accessory articular processes quite as complex as those of the modern armadillos, two additional pairs of pre- and post-zygapophyses occurring on one vertebra from near the hinder part of the thorax.

The tail is stout and evidently quite long, for eighteen caudal vertebræ are associated with one individual and the series is far from complete. The vertebræ resemble those of *Dasypus*, but are relatively shorter; in the anterior caudal region the vertebræ have long, slender and depressed transverse processes; posteriorly these processes become shorter and wider, but are recognizable on the last vertebra preserved. Chevron-bones were present throughout.

The ribs are quite different from those of any other Santa Cruz genus. The first rib, though much broader than the others, is not nearly so expanded and plate-like as in the preceding genera, and presents more laterally, less directly forward than in them; as in the armadillos generally, it has no sternal rib, but articulates directly with the manubrium. The succeeding ribs are remarkable for their thickness, being much less compressed and flattened than in the other contemporary genera. Well ossified sternal ribs are present, though nothing can yet be determined regarding the number of them.

The sternum has an elongate manubrium, which is relatively narrower than in the preceding genera, being especially slender behind the expansion for the attachment of the first pair of ribs, which is very large and prominent; dorsally, the bone is concave and on the ventral side is a prominent median keel. Either this keel differs much in the various species, or else it increases greatly with age, for in the young individual of *P. strepens* it does not agree with Ameghino's account, who describes it as "une forte crête médiane tranchante et d'un développement énorme comparable seulement au bréchet des oiseaux" ('94*a*, 177). A segment of the mesosternum is trihedral, with sharp ventral edge.

Appendicular Skeleton. — Limbs and feet are of a typically armadillo-like character, though almost every bone has its peculiarities. A fragment of the distal end of the scapula exhibits a very broad neck, with hardly an indication of the coraco-scapular notch and with glenoid border raised into a prominent spine-like ridge; the coracoid is large and long remains separate from the scapula. The humerus differs but little from that of *Proeutatus;* the external tuberosity is very large, the internal very small and both are connected by a narrow bridge of bone, which converts the bicipital groove into a foramen, as in *Prozaëdius* (*fide* Ameghino); the deltoid ridge is very large, though hardly so greatly developed as in *Proeutatus*, and much the same may be said of the supinator ridge, while the internal epicondyle is even larger; the trochlea is very low proximo-distally and has an inconspicuous convexity for the head of the radius.

The ulna (Plate XVI, fig. 9) differs little from that of the preceding genera, being short, heavy, and compressed, with very long olecranon; the sigmoid notch is short and rather shallow, but much extended transversely and much more prominent on the internal side than in *Proeutatus;* on the other hand, the shaft is somewhat more slender and the distal end less thickened than in the latter.

The radius (Plate XVI, fig. 10) is characteristic; the head is transversely oval, but narrower and less produced externally than in *Proeutatus*, and bears a simple, shallow concavity for the humerus; for the proximal half of its length, the shaft is slender and subcylindrical, but expands gradually to the distal end, where it forms a broad plate, thus having quite a different appearance from the radius of any other Santa Cruz armadillo; the styloid process is very short.

The carpus (Plate XVI, fig. 11) is almost identical with that of *Proeutatus* and *Dasypus*. The scaphoid is very short and broad, extending obliquely beneath the lunar to a contact with the magnum. The lunar, which is also broad and very short, rests principally upon the scaphoid, but articulates also with the magnum and unciform. As usual, the pyramidal extends beyond the unciform to articulate with metacarpal V. The trapezium is narrow but elongate and has an extensive connection with metacarpal II. The trapezoid is connected with metacarpal III, shutting off metacarpal II from articulation with the magnum, as in *Proeutatus* and *Dasypus*. The magnum is shorter and broader than in the former and the unciform is of the usual pyramidal shape, thinning to an edge on the ulnar side.

The metacarpals are five in number and are somewhat more peculiar than the carpals. The pollex is more reduced than in any other contemporary member of the order and its metacarpal is short, slender and subcylindrical.

Metacarpal II is heavy and has a more expanded head than in *Proeutatus*, with a large facet on the radial side for the trapezium; it is of nearly uniform width throughout, but diminishes in thickness distally, where the trochlea is deeply grooved in the median line and has no trace of a carina, but with a deep pit above it on the dorsal side of the shaft.

Metacarpal III is slightly longer and stouter than metacarpal II, but very like it in form; the distal trochlea has a faintly indicated carina and a larger dorsal fossa.

Metacarpal IV is far shorter than in *Proeutatus*, being less than one half as long as metacarpal III, and also very stout; its trochlea is as in the last named genus and altogether different from that of metacarpals II and III.

Metacarpal V has not been found, but the facets of the adjoining bones prove its presence.

In the only known individual with fairly well preserved feet, the phalanges were so scattered and confused, that I cannot be entirely confident that the arrangement given in the plate is in all respects accurate. In the pollex, the proximal phalanx is slender and longer than metacarpal I, but far shorter than in *Proeutatus;* in digit II it is somewhat shorter and very much heavier, with a well-developed concave trochlea at each end, while in digit III it is still shorter and heavier and has a very prominent median dorsal "beak" on the proximal end.

The second phalanx of digit II is like the first of the same digit and of nearly the same length; in digit III it is, if correctly identified, shorter and more depressed, while in digit V it is very short, broad proximally and narrow distally.

The ungual phalanges are like those of *Proeutatus*, but are shorter, more bluntly pointed and none of them is cleft at the tip; that of the pollex, in correlation with the reduction of the whole digit is relatively much smaller than in any of the preceding genera.

Digit II is the longest of the series, III is somewhat shorter, IV considerably so, while I and V are greatly reduced.

The femur (Plate XVI, fig. 12) is very characteristic and quite unlike that of any other Santa Cruz genus, differing especially from that of *Proeutatus;* the head is rather small, low, depressed and sessile; the fossa for the round ligament is large and shallow; the great trochanter is of only moderate size and smaller even than in *Prozaëdius*, and has a minute digital fossa; the second trochanter is peculiar only in having a more distal position than in the other genera, while the third is more proximal, broader proximo-distally and much less prominent. The shaft is slender and subcylindrical, having proportions not unlike those in *Prozaëdius;* the distal expansion is very moderate, the external crest is almost obsolete and the hook-like process above the inner condyle is very small; the rotular groove is very broad and shallow and the condyles are of unequal size, though the difference is less than in *Proeutatus*, while the intercondylar notch is much wider.

In the young animal tibia and fibula (Plate XVI, fig. 13) are separate, but they are, as usual, coössified in the adult. The tibia is somewhat shorter than the femur and is much more slender than in *Proeutatus;* the proximal condyles are widely separated and there is no spine; the shaft is much compressed and, for most of its length, deeply concave externally, with very faint interosseous crest; the cnemial process is far less prominent than in *Proeutatus*. The external facet for the astragalus is larger and more concave than the internal, from which it is partly separated by a long and broad, but very shallow sulcus, which invades the articular surface from the anterior side and corresponds to a very shallow sulcus on the trochlea of the astragalus; the internal malleolus is small, but larger than in *Proeutatus*, while the posterior median tongue is smaller.

The fibula is quite different from that of the other Santa Cruz armadillos, having a very much more slender and subcylindrical shaft, instead of the usual plate-like form, and has no interosseous crest; the distal end forms a prominent and heavy external malleolus, which has no contact with the calcaneum.

Although not departing from the armadillo type of structure in any radical way, the pes (Plate XVI, fig. 14) is different from that of any other known genus. The proportions of the digits are most like those of *Tatu*, the foot being functionally tridactyl; the three median digits are long, slender and of nearly equal length, while the laterals are so reduced that they can have had little or no function. While this is the plan upon which the pes of *Tatu* is constructed, that of *Peltephilus* receives a very different appearance from the long, slender median digits (II, III and IV) and the hoof-like ungual phalanges.

The astragalus resembles that of *Proeutatus*, with a number of differences; thus, the broad, shallow trochlea is invaded by a sulcus from the distal side, which is not present in the latter; the fibular facet is much less produced externally, and the external calcaneal facet is very different, being nearly proximo-distal in direction, instead of very oblique; it has no such external prolongation and is separated by a broader sulcus from the sustentacular facet.

The calcaneum has a compressed tuber, with almost straight and parallel dorsal and ventral borders, like that of *Stegotherium*, but much shorter, and very different from the broad depressed tuber of *Proeutatus;* the external astragalar facet is much less oblique than in the latter and there is no articulation with the fibula; the sustentaculum is very prominent and its facet small.

The navicular is of the usual armadillo type, from which it departs less than does that of *Stegotherium*.

The entocuneiform is like that of *Proeutatus*, except for its greater length. The mesocuneiform is, as usual, extremely small, and the ectocuneiform very large. The cuboid differs in several respects from that of the other genera; it is larger, has a more massive and prominent plantar hook and a much less oblique calcaneal facet; the distal end is covered by the large facet for metatarsal IV, that for metatarsal V is extremely small and confined to a projection from the antero-external angle.

Metatarsal I is a little longer and stouter than metacarpal I, but the hallux is greatly reduced and hardly so long as metatarsal II.

Metatarsals II, III and IV are of nearly equal length, but, owing to the arrangement of the tarsals, metatarsal III extends farthest distally, while metatarsals II and IV make a nearly symmetrical pair; these bones are all slender and elongate, much exceeding the corresponding metacarpals in length and in striking contrast to the short, heavy metatarsals of *Proeutatus* and *Stegotherium*. A very characteristic peculiarity of the metatarsals of *Peltephilus* is the high, pulley-like, deeply grooved distal trochlea, which is so exceedingly different from that seen in other armadillos; the fossa on the dorsal side of the shaft, just above the trochlea, is also, especially that of metatarsal III, much deeper and more conspicuous than in any of the other genera. Metatarsal II has a curved shaft, of roughly trihedral section, and that of metatarsal IV is its counterpart, while the shaft of metatarsal III is straight and of subcircular section.

Metatarsal V is very much reduced and shorter than metatarsal I, though somewhat heavier; its trochlea is almost plane and quite concealed by the first phalanx.

The phalanges are in remarkable contrast to those of the manus, being so much smaller that it seems difficult to believe that they belonged to the same animal. In digit I the proximal phalanx is short, slender and slightly contracted in the middle; in digits II, III and IV this phalanx becomes successively shorter and broader, while in V it is very much shortened, almost cubical and with nearly plane articular faces.

The second phalanx is longest in digit II, somewhat shorter and much stouter in II, still shorter in IV and shortest of all in V.

The unguals are altogether different from those of the manus, being short, broad, depressed, very blunt and hoof-like rather than claw-like. No other Santa Cruz armadillo has unguals at all like these. In the hallux the ungual is extremely small; in digit III it is symmetrical, and broader, more depressed and more obtuse than in the others; in digits III and IV it is asymmetrical, thicker and more pointed and in digit V it is small, but larger than that of I.

Systematic Position. — Although the skeleton of *Peltephilus* is not so completely known as that of several other Santa Cruz genera, the material is sufficient to justify a decision upon its relationships and taxonomic position. Ameghino has been so much impressed by the peculiarities of the genus, that he has erected for it a separate order of the Edentata ('94*a*, 175). On the other hand, Moreno and Mercerat refer it to the Dasypoda and even to the *Dasypodidæ* ('91, 57).

That *Peltephilus* should stand as the representative of a distinct family, seems abundantly clear, its peculiarities of carapace, dentition and skeleton being so many and so striking, and its isolated position, with reference to all the other contemporary genera, being so marked. At the same time, as the foregoing description will show, *Peltephilus* is a genuine armadillo, but with many divergent specializations, which lead away from the other members of the suborder. In spite of the retention of a few primitive features, it may be regarded as one of the most highly differentiated of all known armadillos. However, none of these peculiarities is radical, or fundamental; the armadillo type is apparent in every part of the structure and it seems altogether unnecessary, as well as misleading, to remove the genus from the Dasypoda. Like *Stegotherium*, *Peltephilus* formed the terminal member of its series, for no representative of this line has been found in any formation later than the Santa Cruz.

PELTEPHILUS STREPENS Ameghino.

(Plate XVI, figs. 7–14.)

Peltephilus strepens Amegh.; Enumeracion sistematica, etc., 1887, p. 25.

Cochlops muricatus Amegh., in part; Contrib. al Conoc. de los Mamif. Fos. de la Rep. Arg., 1889, p. 792.

Peltephilus heusseri Moreno and Mercerat; Revist. del Mus. de La Plata, T. II, 1891, p. 61.

This is one of the larger species of the genus, being exceeded only by *P. grandis;* it is further characterized by certain features of the posterior median plate of the cephalic shield, which is relatively long and narrow with a well-defined raised border around the sides and anterior end; in addition to the general rugosity of the surface, there are several large and shallow pits and, in particular, one near the hinder border is conspicuous. The dimensions of this plate are: length, 33 mm.; width of posterior border, 30.5 mm.; of anterior border, 15 mm.

The imperfect young skeleton (No. 15,390) described in the account of the genus has yielded the following

MEASUREMENTS.

Axis, length of centrum	.013
" " of odontoid process	.010
" width of anterior face	.031
Scapula, width of neck	.018
Scapula, antero-posterior diameter of glenoid cavity	.018
Scapula, transverse diameter of glenoid cavity	.012
Ulna, length	.085
Ulna, length of olecranon exclusive of epiphysis	.028
Ulna, width of sigmoid notch	.020
" " of distal end	.009
Radius, length	.053
" width of proximal end	.014
" " of distal end	.016
Carpus, length in median line	.011
" width	.027
Metacarpal I, length	.0095
" " width of proximal end	.005
" " " of distal end	.004
Metacarpal II, length	.027
" " width of proximal end	.007
" " " of distal end	.008
Metacarpal III, length	.0285
" " width of proximal end	.0095
" " " of distal end	.0085
Metacarpal IV, length	.011
" " width of proximal end	.008
" " " of distal end	.008
First phalanx, digit I, length	.011
First phalanx, digit I, width of proximal end	.004
First phalanx, digit II, length	.013
First phalanx, digit II, width of proximal end	.009
First phalanx, digit III, length	.011
First phalanx, digit III, width of proximal end	.010
Ungual phalanx, digit I, length	.009
Ungual phalanx, digit I, width of proximal end	.0045
Ungual phalanx, digit II, length	.022
Ungual phalanx, digit II, width of proximal end	.008
Ungual phalanx, digit III, length	.0225
Ungual phalanx, digit III, width of proximal end	.0085
Ungual phalanx, digit IV, length	.020
Ungual phalanx, digit IV, width of proximal end	.009
Ungual phalanx, digit V, length	.0175
Ungual phalanx, digit V, width of proximal end	.008
Femur, length from head	.084
" " from great trochanter	.090
" width of proximal end	.030
" " of distal end	.025
Tibia, length	.083
" width of proximal end	.027
" " of distal end	.012
Fibula, thickness of proximal end	.010
Astragalus, length	.020
" width of trochlea	.016
Calcaneum, length	.033
" " of tuber	.023
Metatarsal I, length	.014
" " width of proximal end	.0045

MEASUREMENTS.

Metatarsal II, length	.033
" " width of proximal end	.008
Metatarsal III, length	.034
" " width of proximal end	.010
Metatarsal IV, length	.033
" " width of proximal end	.007
Metatarsal V, length	.008
" " width of proximal end	.006
First phalanx, digit I, length	.009
" " " II, "	.012
First phalanx, digit II, width of proximal end	.007
First phalanx, digit III, length	.009
" " " IV, length	.008
" " " V, length	.004

Ungual, digit I, length	.009
" " " width of proximal end.	.0045
" " II, length	.0125
" " " width of proximal end.	.007
" " III, length	.013
" " " width of proximal end.	.0085
" " IV, length	.013
" " " width of proximal end.	.007
" " V, length	.010
" " " width of proximal end.	.0065
Digit I, length	.031
" II, "	.065
" III, "	.065
" IV, "	.060
" V, "	.027

PELTEPHILUS PUMILUS Ameghino.

(Plate XVI, figs. 3–5.)

Peltephilus pumilus Amegh.; Enum. sistematica, etc., 1887, p. 25.
Peltephilus pumilus Moreno and Mercerat; Rev. del Museo de La Plata, T. II, 1891, p. 82.
Peltephilus strepens Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 70.

In size, this is one of the smaller species, though it is not much inferior to *P. ferox*. The dentition has certain characteristic features: $^{\underline{1}}$ is placed transversely in the premaxilla, so as to be almost concealed in side-view by $^{\underline{2}}$, which is the most prominent of the teeth; $^{\underline{3}}$ is lower, but larger in the other dimensions. From $^{\underline{2}}$ to $^{\underline{5}}$ inclusive each tooth has on the outer side a vertical groove near the hinder border, which is thus raised into an inconspicuous pillar.

The cranium is quite convex in the antero-posterior direction and the descent from the forehead to the rostrum is quite abrupt; the rostrum itself is relatively short. The sagittal crest is feebly developed and is accompanied to the coronal suture by a narrow, faintly marked sagittal area, the borders of which become continuous with the still more obscure temporal ridges. Anteriorly, the tubular prolongation of the nasals and the ascending rami of the premaxillaries are short and the median anterior spine-like process from the line of suture is very small.

The measurements are from an individual (No. 15,391) which is somewhat larger than the type.

MEASUREMENTS.

Upper dentition, length	.029
" " " $\underline{2}$–$\underline{7}$, inclusive	.028
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.003
" width (*i. e.*, transverse diameter)	.004
$\underline{2}$, length	.004
" width	.004
$\underline{3}$, length	.005
" width	.004
$\underline{4}$, length	.0045
" width	.003
$\underline{5}$, length	.005
" width	.003
$\underline{6}$, length	.004
" width	.025
$\underline{7}$, length	.002
" width	.002
Skull, length in median basal line	.078
" extreme length	.092
Cranium, length to anterior rim of orbit	.065
Face, length	.031
Occiput, height	.032
" width at base	.052
Zygomatic arch, length	.040
Rostrum, width at infraorbital foramen	.030
" " " anterior end	.021
Palate, length	.034
" width at $\underline{3}$	.016
" " " $\underline{7}$	.021

PELTEPHILUS FEROX Ameghino.

(Plate XVI, figs. 1, 2.)

Peltephilus ferox Amegh.; Rev. Arg. de Hist. Nat., T. I, 1891, p. 327.
Peltephilus clarazianus Moreno and Mercerat; Rev. d. Mus. de La Plata, I, 1891, p. 60.

Although this species is not represented in the Princeton collection, I am enabled by the courtesy of Dr. Ameghino to figure the beautiful specimen which he has described. In size, *P. ferox* is intermediate between *P. strepens* and *P. pumilus*, and were size alone to be considered, the species could not be regarded as valid, so great is the variation in this respect. A more important diagnostic character is afforded by the postero-median scute of the cephalic shield, the shape and sculpture of which appear to be quite constant in each species. In *P. ferox* this plate is both actually and relatively smaller than in *P. strepens* and is of a different shape, being considerably shorter and wider and measuring 24 mm. in length and 26 mm. in greatest width. As in the latter species, there is a raised border around the margins of the plate, but the surface is not so rough and has no such irregular depressions and pits.

The teeth differ in a number of respects from those of *P. pumilus*. In the upper jaw $\underline{1}$ is the highest of the series, while in the latter $\underline{2}$ is the highest; it also stands well in advance of $\underline{2}$ and is visible in side-view;

$\underline{2}$ has a greater antero-posterior diameter than in *P. pumilus.* The groove on the outer face of the crown is more distinct in $\underline{3}$ to $\underline{6}$ than in the corresponding teeth of the latter species and is more nearly in the middle of the outer side.

The skull has several differences from that of *P. pumilus;* the cranium is somewhat shorter and the rostrum longer proportionately; the cranium contracts forward more rapidly to a more definitely marked postorbital constriction, but is less vaulted, so that the descent at the forehead is somewhat less steep. The occipital crest is more prominent, making the temporal fossæ more concave, and the sagittal crest is much better developed and extends forward upon the frontals, a difference which is demonstrably not due to age, but may possibly be due to sex. The elongation of the rostrum is particularly well marked in the dorsal region, where the nasals project freely beyond the edge of the premaxillæ and the dorsal ends of the ascending rami extend much farther beyond the alveolar portion of the premaxillæ than in *P. pumilus;* the median spine-like projection from the line of suture between the two premaxillaries is very much more prominent than in the latter species.

MEASUREMENTS.

Upper dentition, length	.036	$\overline{1}$, length	.002
" " " $\underline{2\text{-}1}$ inclusive	.032	Skull, length on median basal line	.090
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.0035	" extreme length	.112
		Cranium, length to anterior rim of orbit	.070
$\underline{2}$, length	.004	Face, length	.042
$\underline{3}$, "	.005	Occiput, height	.042
$\underline{4}$, "	.0045	Zygomatic arch, length	.051
$\underline{5}$, "	.0043	Mandible, length	.063
$\underline{6}$, "	.0035	" depth below $\overline{6}$	.014

PELTEPHILUS GRANDIS Moreno & Mercerat.

(Plate XVI, fig. 6.)

Peltephilus grandis M. and M.; Rev. Mus. de La Plata, T. II, 1891, p. 62.

Peltephilus giganteus Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 179.

Peltephilus giganteus Lydekker; Anales del Museo de La Plata, T. III, 1894, p. 70.

The largest species of the genus, characterized not only by its large size, but also by the form and sculpture of the postero-median scute of the cephalic shield. This plate is relatively broader than in the two preceding species, the breadth exceeding the length. A specimen in the Ameghino collection yields the following measurements: length, 40 mm., breadth of posterior border, 45.5 mm., breadth of anterior border 22 mm. The exposed surface of the plate is very rough and coarsely pitted, with large irregular depressions; it has no such raised border as in *P. strepens* and *P. ferox*, except a slight indication of it on the sides.

In the original account of this species by Moreno and Mercerat an element of confusion was introduced by describing $_{\overline{2}}$ as $_{\overline{1}}$, which is very small in all the species.

PELTEPHILUS NANUS Ameghino.

Peltephilus nanus Amegh.; Secundo Censo d. Repúb. Arg., 1898, p. 220.

Very little is known of this species, but the scutes of the carapace justify its reference to the present genus, while the extremely small size (the femur is only 62 mm. long) indicates its specific distinctness.

?PELTEPHILUS RARUS Ameghino.

Anantiosodon rarus Amegh.; Rev. Arg. d. Hist. Nat., T. I, 1891, p. 327.

Ameghino's original description of this species and supposed genus is as follows: "Represented by a piece of the right mandibular ramus, with part of the symphysis; the ramus is delicate and has its ventral border turned inward for its whole length; the symphysis is narrow and rounded. In the ramus are not more than four compressed teeth, with major diameter somewhat oblique and with structure apparently like that of the Dasypoda. The whole piece is strongly curved. Length of space occupied by the four teeth, 18 mm., depth of jaw below teeth, 10 mm."

The type-specimen is a very unsatisfactory fragment, from which little can be learned. It is probably referable to *Peltephilus*, perhaps even to some of the preceding species, but its determination must await the discovery of better material.

GENERA INCERTÆ SEDIS.

Ameghino has named two other genera of Santa Cruz armadillos, *Præuphractus* and *Vetelia*, concerning which I can add nothing to what he has already published. I shall therefore merely give the literature dealing with these doubtful forms.

PRÆUPHRACTUS Ameghino.

Præuphractus Amegh.; Bol. de la Acad. Nac. de Cien. de Cordoba, T. IX, 1886, p. 206.

Præuphractus Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Rep. Argent., 1889, p. 868.

Eodasypus Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 173.

Dasypus Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 55.

Proeuphractus Amegh.; Secundo Censo de la Repúb. Argent., T. I, 1898, p. 218.

PRÆUPHRACTUS NANUS Ameghino.

Præuphractus nanus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 253.

Eodasypus nanus Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 173.

? Dasypus patagonicus Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 60.

Proeuphractus nanus Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 218.

PRÆUPHRACTUS LIMUS Ameghino.

Præuphractus limus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 254.

Eodasypus limus Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 173.

? Prodasypus patagonicus Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 60.

Proeuphractus limus Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 218.

VETELIA Ameghino.

? Chlamydotherium Amegh. (*non* Lund); Enum. sistem., etc., 1887, p. 25.

? Pampatherium Amegh., in part; Rev. Argent. de Hist. Nat., T. I, 1891, p. 252.

Peltephilus Lydekker, in part; Anales del Museo de La Plata, T. II, 1894, p. 67.

Vetelia Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 162.

VETELIA AUSTRALIS Ameghino.

? Chlamydotherium australe Amegh.; Enum. sistematica, etc., 1887, p. 25.

? Chlamydotherium australe Amegh.; Contr. al Conoc. de l. Mam. Fos. de la Repúb. Argent., 1889, p. 858.

? Pampatherium australe Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 253.

Vetelia australis Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 172.

Vetelia australis Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 217.

VETELIA PUNCTA Ameghino.

Vetelia puncta Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 162.

Vetelia puncta Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 172.

Peltephilus strepens Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 68.

Vetelia puncta Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 217.

VETELIA PYGMÆA Ameghino.

? Pampatherium pygmæum Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 253.

Vetelia pygmæa Amegh.; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 172.

Peltephilus strepens Lydekker, in part;. Anales del Museo de La Plata, T. III, 1894, p. 68.

Vetelia pygmæa Amegh.; Sec. Censo de La Repúb. Argent., T. I, 1898, p. 217.

EXPLANATION OF PLATE I.

		PAGE
Fig. 1.	STEGOTHERIUM TESSELATUM: Part of the carapace (No. 15,565) .	13
Fig. 2,	" " The same from another point of view.	

(Natural size.)

GLYPTODONTIA.

The Santa Cruz glyptodonts have already attained a high degree of specialization, but they are in many respects distinctly more primitive than those of the Pampean and were obviously converging to a common ancestry with the armadillos. So far as the available material enables us to judge, there is comparatively little variety among them, the differences between the five genera that have been described being of a very subordinate kind, and none of them is known to persist to a later epoch.

1. The most striking distinction between these genera and those of later times is in size; the Santa Cruz species are all small, some of them very small, and only those of a single genus, *Eucinepeltus*, approximate the lesser Pampean species in stature.

2. In all cases the carapace is made up of transverse bands or rows of plates, which doubtless permitted a certain degree of flexibility, as is shown by the fact that on the sides of the carapace, near the anterior end, are two or three rows of overlapping, imbricating plates, like those of the armadillos. There is, however, a surprising amount of variability in the number of these movable bands, even on the two sides of the same individual. It is unusual to find any of the scutes fused with their neighbors; I have observed this only in *Cochlops* and then it consisted merely in the coalescence of two or three adjoining plates. The sculptural pattern of the plates is remarkably uniform throughout the genera of the period and agrees closely with that of the Pampean *Sclerocalyptus* (*Hoplophorus*), but the plates are relatively thinner and the grooves which make the pattern are shallow. The central figure of each plate is a large oval or, it may be, an obscurely marked polygon, and from its bounding groove radiate a number of short, nearly straight furrows, which demarcate the smaller peripheral figures. The central figure may be plane, slightly concave, or moderately convex, but only in *Cochlops* has any notable departure from the general plan of ornamentation been observed. In that genus we find on each side of the middle line in the pelvic region, an area in which the pattern of ornamentation characteristic of the remainder of the carapace is extensively modified. In these areas several of the plates display no particular pattern, but merely have a very rough surface, without definite grooves or figures, while in other scutes the central figure is raised into a very high, rugose, bluntly pointed cone,

and the peripheral figures become prominent conical tubercles. Each of the areas has one plate, or sometimes two, in which this modification is extreme. All of the genera have a row of marginal plates around the borders of the carapace, which also display a modification of the sculpture; these plates will be more particularly described in connection with *Propalæohoplophorus*.

3. The tail-sheath, which is likewise of very uniform character in nearly all of the genera, consists of two quite distinct portions, of which the anterior one is composed of four or five freely movable rings, each ring having two rows of plates and overlapping the one behind it; in this region the ornamentation is very similar to that of the carapace; in the posterior part of the sheath the rings, though still imbricating, are much more closely fitted and less movable, and the plates, which are smaller, have no definite sculpture, merely a punctate surface. The number of rings composing [this posterior part of the tail-sheath appears not to exceed four or five, and the shape of the mass differs somewhat in the various genera in which this structure is known; in *Propalæohoplophorus* it is heavy and club-like, tapering but little and ending abruptly, the tube being closed by a small irregular plate; in *Cochlops* it is similar, but more tapered and with thinner plates; in *Asterostemma* it is elongate and much more tapering, ending in a point, and made up of obscurely marked rings, each consisting of a single row of plates. This difference between *Asterostemma* and the other genera is not without importance, for in the former may be observed a distinct approximation to the structure of the armadillos. No coössification occurs between the various plates of the tail-sheath.

4. In the cephalic shield there is much more variety, each genus appearing to have its own characteristic form. However, this statement cannot yet be positively made, for the head-shield of *Metopotoxus* is very imperfectly known and that of *Asterostemma* not at all. In *Propalæohoplophorus* the component plates of the shield are all separate and quite thin and most of them are of relatively large size; the ornamentation is similar to that of the carapace, but the demarcating grooves are extremely shallow, and the surface of the plates is quite smooth and finely punctate. In *Cochlops* the plates, likewise separate, are more numerous, and relatively smaller and thicker; the pattern is made by much deeper grooves, and the surface of the plates is decidedly rougher and more coarsely

punctate. *Eucinepeltus* has quite a different type of head-shield; the plates, eleven or fifteen in number, are all coössified into a single massive bone and the sutural lines between more or fewer of them are elevated into very prominent, sharp and jagged ridges; no sculptural pattern is apparent, but in a greater or less number of the plates, varying in the different species, is a deep central pit, and the whole surface of the shield is coarsely punctate. In *Metopotoxus* the pattern appears to be nearly obliterated, the grooves being very obscure or entirely absent.

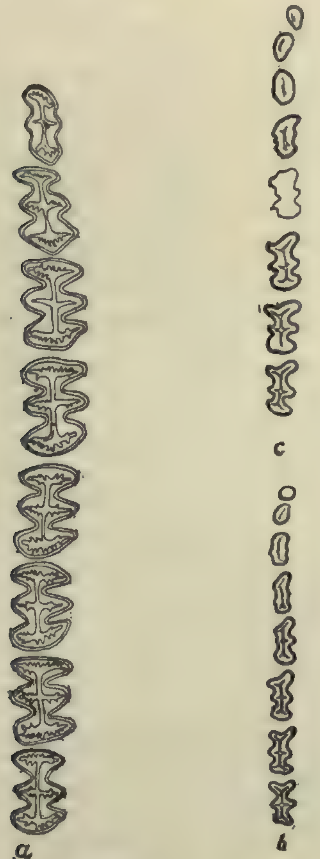

FIG. 8.

Upper teeth of glyptodonts, × $\frac{1}{2}$. *a*, *Glyptodon asper*, left side (after Burmeister); *b*, *Propalæohoplophorus australis*, right side; *c*, *Eucinepeltus petestatus*, right side.

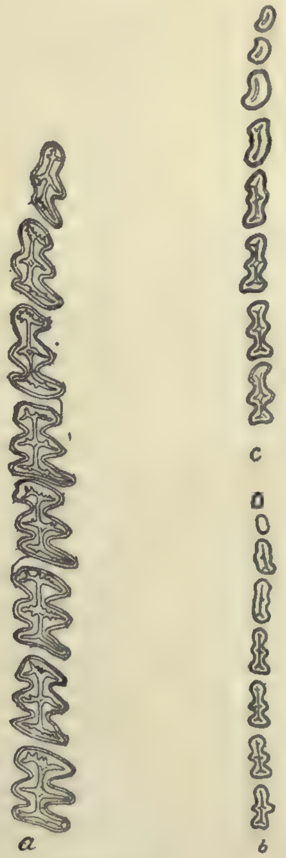

FIG. 9.

Lower teeth of glyptodonts, left side, × $\frac{1}{2}$. *a*, *Glyptodon asper* (Burmeister); *b*, *Propalæohoplophorus australis*; *c*, *Eucinepeltus petestatus*.

5. The hair must have been scantily developed, as is indicated by the number and size of the piliferous pits. In the carapace these pits are small and are placed at the intersection of the radiating grooves of the

plates with the central groove, also at the angles of the peripheral figures, and much the same is true of the head-shield and tail-sheath. In *Eucinepeltus* the ridges marking the lines of suture between the coalesced plates have quite large and conspicuous pits, and they are also unusually well marked in *Metopotoxus*. In the posterior portion of the tail-sheath, where the plates have no ornamental pattern, the pits are situated somewhat irregularly around the borders of the plates, except in *Asterostemma*, which seems to lack them entirely.

6. The teeth of the Santa Cruz glyptodonts differ from those of the succeeding genera in their less extreme hypsodontism, in their less symmetrical form and in the greater simplicity of the anterior ones, although in the Pampean *Sclerocalyptus* $\underline{1}$ and $\underline{2}$ are still very simple. Almost every well preserved specimen of *Propalæohoplophorus* shows one or two minute alveoli in each premaxillary, which apparently served for the insertion of vestigial incisors, but the teeth themselves have not been observed and were probably shed or resorbed at an early period. The functional teeth, always $\frac{8}{8}$ in number, differ relatively little in the various genera, but each genus may usually be identified from the teeth alone. Thus, in *Asterostemma* the posterior upper teeth ($\underline{5}, \underline{6}, \underline{7}, \underline{8}$) show no sign of a division of the

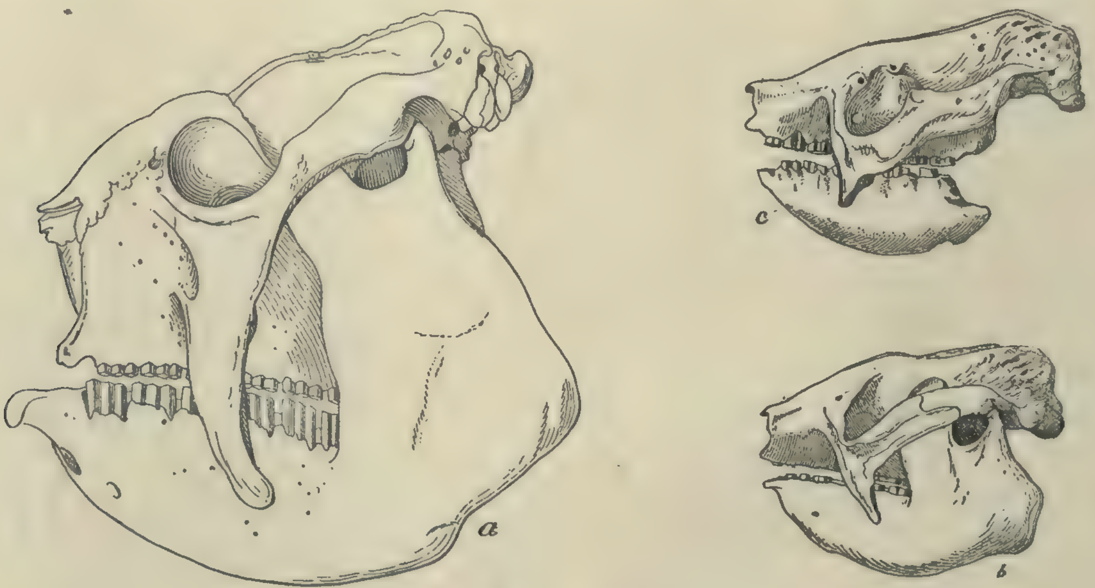

FIG. 10.

Skulls of glyptodonts, left side, × $\frac{1}{4}$; *a. Glyptodon asper* (after Burmeister); *b. Propalæohoplophorus australis*; *c. Eucinepeltus complicatus* (mandible from *E. petestatus*).

postero-external lobe by a vertical groove; in *Eucinepeltus* this division is very feebly indicated, while in *Propalæohoplophorus* it is quite distinct, in *Cochlops* strongly marked and in *Metopotoxus* still more so, and this genus is still further distinguished by the unusual complexity of $\underline{4}$. The later glyptodonts are characterized by the complexity of the anterior teeth, by the absence of any division of the postero-external lobe (except in $\underline{8}$ of *Sclerocalyptus*) and by the enlargement of the outer lobes, which makes the grinding surface much more symmetrical. Still another difference between the Santa Cruz and the later genera is in the form of the median ridge of harder dentine on the masticating surface, which is much more complexly ramified in the Pampean types.

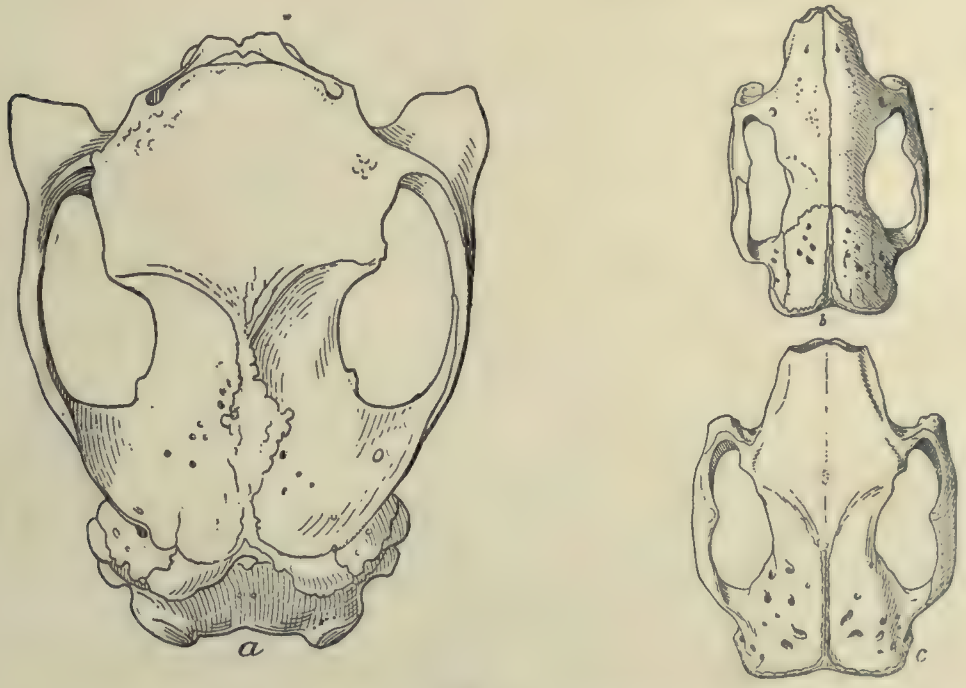

FIG. 11.

Skulls of glyptodonts, top view, $\times \frac{1}{4}$; *a. Glyptodon asper* (after Burmeister). *b. Propalæohoplophorus australis*; *c. Eucinepeltus complicatus.*

7. The skull is quite completely known in nearly all of the genera, but only in *Propalæohoplophorus* has any considerable part of the skeleton been recovered. However, there is no reason to suppose that noteworthy differences in skeletal structure existed between the various genera. As compared with the Pampean genera, the Santa Cruz glyptodonts have a type of skull which is characterized by the elongate rostrum, the low jaws,

the widely open orbits, the relatively high and erect occiput, and the distinct occipital and sagittal crests. There is no such development of air-sinuses and, in consequence of the less exaggerated height of the teeth, the ascending ramus of the mandible is much lower. A partial exception to this description is afforded by the skull of *Metopotoxus*, in which the occipital plane has a decided forward inclination and the rostrum is shortened and directed steeply downward, much as in *Panochthus*.

Despite the above-mentioned differences, however, the glyptodont nature of the skull in these Santa Cruz genera is apparent at the first glance, and the characteristic descending suborbital process from the zygomatic arch is already a most striking feature.

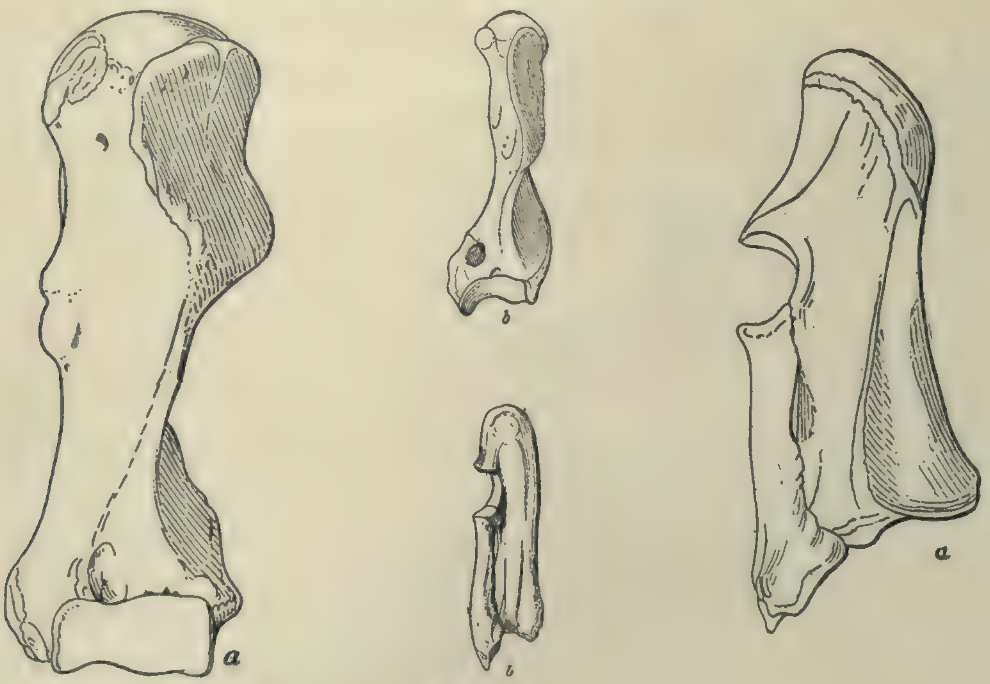

Fig. 12.

Bones of left fore-limb of glyptodonts, × ¼. ***a. Glyptodon asper*** **(after Burmeister).** ***b. Propalæohoplophorus australis.***

8. The vertebral column has nearly, but not quite, attained to the degree of concentration found in the later genera of the group. The neck is very short; the atlas is free, but the axis and the three succeeding cervicals (in *Metopotoxus* only two) are fused into a compound bone; the sixth again is free, while the last cervical, first and second thoracics have coalesced. Two or three of the succeeding thoracic vertebræ are separate,

while the remaining ones are coössified together and with the first lumbar to form the "dorsal tube," while the remaining lumbars and the sacrals unite in the "lumbo-sacral tube." The caudal vertebræ are characteristically glyptodont in form.

9. The scapula is relatively high and narrow and finds its nearest analogue, among the Pampean genera, in *Sclerocalyptus*. In the pelvis, the ilium and ischium meet at a more open angle than do those of the later genera and the obturator foramen is larger.

10. The hind-limb is much longer than the fore-limb, which produces the extreme curvature of the vertebral column. Proportionately, the limb-bones are much more elongate and slender than in the subsequent genera, *Sclerocalyptus* approximating the Santa Cruz type in this respect more closely than do the other Pampean forms.

11. The humerus is quite slender and retains well-developed deltoid and supinator ridges and large epicondylar foramen, its whole appearance resembling that of the large Santa Cruz armadillos, and the same resemblance is found in the radius, while the ulna is very broad and has a more typically glyptodont shape, though it is far less massive than in the Pampean genera. The manus is very incompletely known, but the parts that have been recovered indicate its likeness to that of *Sclerocalyptus*, except that the claws are narrower and more pointed and that, probably, the pollex was retained.

12. The femur is very much more slender than in the later glyptodonts and is much more armadillo-like; the third trochanter arises but little below the middle of the shaft, instead of just above the external condyle. The tibia and fibula are completely fused at both proximal and distal ends, and are relatively short, laterally compressed and very thick antero-posteriorly; except for their much greater slenderness, they resemble those of the later glyptodonts in form. The pes is pentadactyl, broad and very short, not unlike that of *Sclerocalyptus* in its proportions; the ungual phalanges are thoroughly hoof-like.

13. Of the three families into which it is usual to divide the glyptodonts, only two, the *Glyptodontidæ* and *Dœdicuridæ*, have so far been found in the Santa Cruz fauna, although it is probable that the *Sclerocalyptidæ* had already come into existence at that time.

14. The Santa Cruz glyptodonts are decidedly more primitive than those of later epochs, and to a certain extent they bridge over the gap be-

tween the glyptodonts and the armadillos, for the primitive features are, for the most part, points of resemblance to the latter group. A much more difficult task is to determine the relationships between these Santa Cruz genera and their successors in time. With the materials now avail-

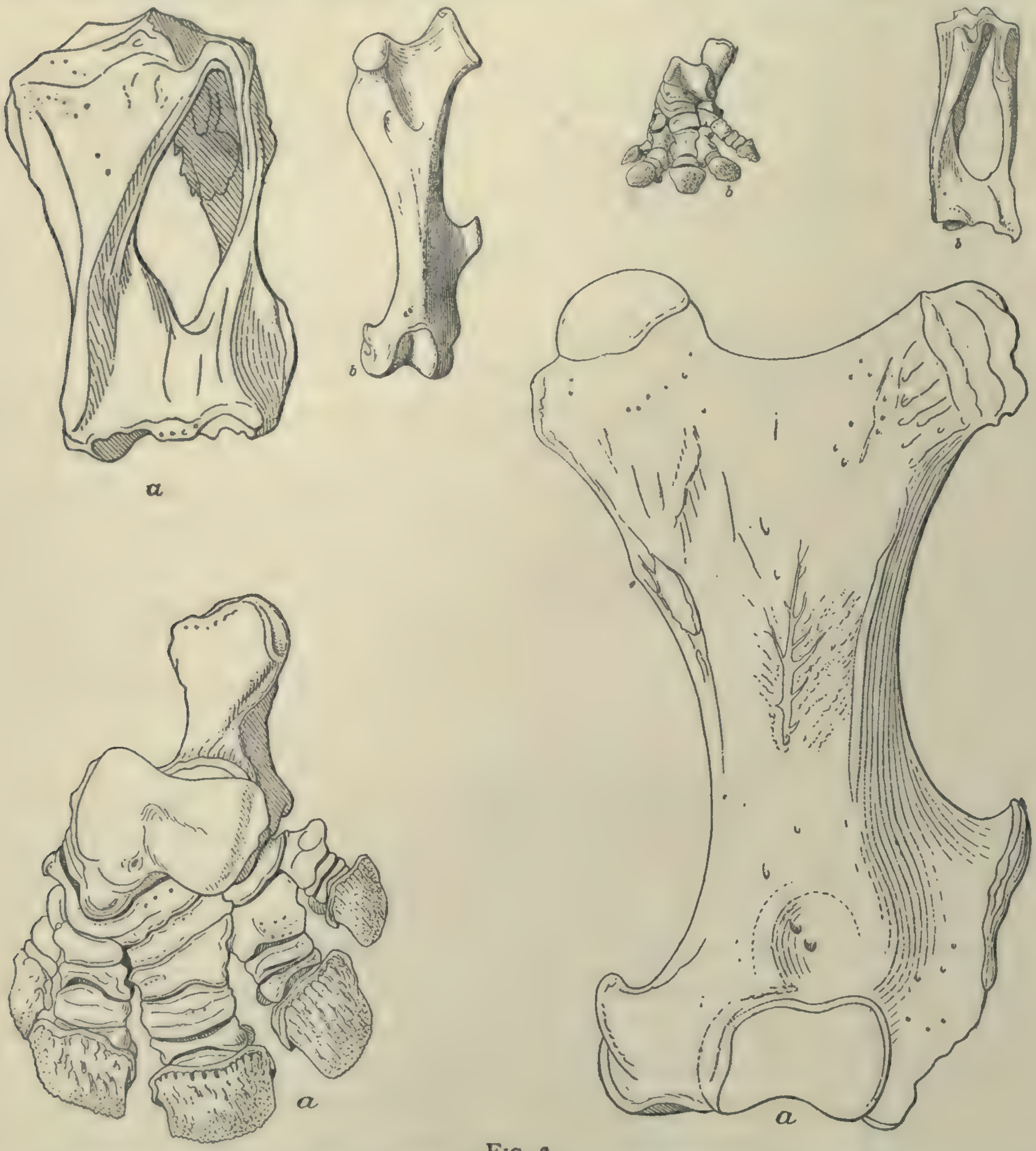

FIG. 3.

Bones of the left hind-leg and foot of glyptodonts, × ¼. *a. Glyptodon asper* (after Burmeister). *b. Propalæohoplophorus australis.*

able, such determination can be made only in the most general terms. *Cochlops* and *Eucinepeltus* are probably without phylogenetic significance and represent lines that did not persist beyond the Santa Cruz formation. On the other hand, *Asterostemma* and *Propalæohoplophorus* are types that, while they may not have actually been ancestral to any of the Pampean genera, are yet not far removed from the common ancestor of them all, and are therefore of great importance. Though still very incompletely known, *Metopotoxus* would appear to be the forerunner of *Panochthus*.

GLYPTODONTIDÆ.

PROPALÆOHOPLOPHORUS Ameghino.

(Plates XVII, XVIII, XXI, Fig. 1; XXII, XXIII, XXIV, Figs. 1–6, 14; XXV–XXVII.)

Hoplophorus Moreno, *non* Lund; Patagonia, Resto de un antiguo Continente hoy Submergido, 1882, p. 26.

Propalæohoplophorus Amegh.; Enumeracion sistem., &c., 1887, p. 24.

This is by far the most abundant of the Santa Cruz glyptodonts and is, for that reason, the most completely known, but much still remains to be learned concerning it, and very extensive additional material will be required before the limits of its surprising variability can be determined. By combining the material in the collection of Dr. Ameghino with that in the museums at La Plata, New York and Princeton, an almost complete account of the structure of this genus may be given.

Exoskeleton.—One of the most characteristic features of this genus is the cephalic shield (Plate XXI, fig. 1) which differs decidedly from that of any contemporary glyptodont in which the shield is known. The component plates are all separate from one another and probably numbered 28 or 29; in the posterior portion they are arranged in three transverse bands, the two hinder bands each of four plates and the third band of three plates; in the anterior part of the shield are nine or ten smaller plates arranged in longitudinal rows and, finally, over and behind each orbit is a series of four small plates; much the largest of the plates are the four formed by the median pair of the posterior two bands. The sculpture of the head-shield is essentially like that of the carapace; there is a large central, more or less convex figure, of irregularly oval or polygonal shape, surrounded by very much smaller polygonal figures, but the bounding grooves are very shallow and consequently the figures are in low relief; the piliferous pits are arranged in two concentric circles and are much more conspicuous than those of the carapace, and the whole surface of the plate is relatively smooth and finely pitted; the small supraorbital scutes are finely punctate, without definite pattern.

The fragments of the head-shield which Lydekker has figured as belonging to this genus ('94, Pl. XXX, figs. 2, 3), are incorrectly assigned, most of them being referable to *Eucinepeltus.*

The carapace (Plates XVII, XVIII) is remarkably variable, but it remains to be determined how far this variability is individual and how far specific. Much the most complete carapace that I have seen is the one figured on Plate XVII, which was collected by Mr. Brown for the American Museum of Natural History and was found in association with a considerable part of the skeleton, including a skull of very unusual type. In its form and proportions this carapace is quite similar to that of *Glyptodon*, but the pattern of ornamentation is more like that of *Sclerocalyptus.* The carapace is made up of twenty-seven transverse bands of plates, counted along the ventral margin, but not more than nineteen or twenty in the median dorsal line. The anterior opening has its sides extended considerably farther forward than its top, and its margin is, of course, formed by the first row of plates; this row, which is not seen in the figure, being turned in toward the opening, is composed of very small plates, the smallest in the carapace, and they are ornamented merely by the central oval, with its bounding groove, the peripherals being entirely absent or extremely small. The lateral projections are formed by the bifurcation of the first, second and fourth rows of plates, so that the first movable band, which is the tenth row along the margin, becomes continuous with the seventh row near the median dorsal line. The other additional rows of the sides of the carapace are produced by the bifurcation of two bands near the hinder end. On the sides of the carapace are two movable bands of imbricating scutes, which extend upward for rather more than one third of the vertical height of the shell; the posterior border of the ninth fixed row is bevelled and extends over the tenth, while the anterior border of the twelfth row is likewise bevelled and overlapped by the second movable band. There is much variation in the number of these movable bands; in the specimen described by Lydekker ('94, p. 47) there are three such bands, while a carapace in the Princeton collection (No. 15,512, Plate XVIII) has three on one side and none at all on the other.

The plates vary much in size and thickness in the different parts of the carapace; in the anterior region they are small and quite thick, posteriorly they become larger and thinner, especially along the median dorsal line, and reach a maximum size in the pelvic region, but in each transverse band the plates grow smaller toward the lateral margins.

As compared with the great Pleistocene genera, the plates of this carapace are smooth and the sculpturing shallow. The pattern is that of a large central figure, which in the anterior and lateral regions is oval and in the large plates of the median and posterior regions becomes subcircular; in most of the plates this central figure is flat, but in a varying number of the scutes in the posterior region it is distinctly convex and in some specimens a small, rough tubercle arises in the center of the figure, forming a partial transition to *Cochlops*. This large central figure is slightly eccentric in position and is placed a little nearer to the hinder margin; it is bounded by an obscurely polygonal groove, from which radiate other short grooves, marking out the small peripheral figures, of which there is usually a single row on each plate and, owing to the eccentric position of the large figure, the anterior peripherals are somewhat larger than the posterior. Many scutes of the lateral region have a more or less complete second row of anterior peripherals and thus, as Lydekker has expressed it, two complete rings of polygonal peripherals, "or a suturally divided single one may intervene between two centrals." Small, pinhole like, piliferous pits are placed at the junctions of the main groove with the radiating grooves, and at the intersections of the latter.

The marginal scutes are considerably modified; on the anterior border the plates have no anterior peripherals and extremely small posterior ones; on the hinder border the posterior peripherals are wanting and the central figure is drawn out into a blunt point, thus forming the serrate hinder edge of the carapace; on the lateral margin the plates have very small inner peripherals, and the narrow, elongate central forms the actual margin; as each of these plates increases in width posteriorly, the hinder portion of the plate projects below the level of the next succeeding one, producing a moderate serration of the border.

No complete specimen of the tail-sheath (Plate XVIII, figs. 2, 3) has yet been obtained, but by comparing a number of imperfect individuals, it may be fairly well reconstructed. The sheath consists of two quite distinct portions, an anterior portion, made up of quite freely movable, imbricating rings, each of two rows of plates; the number of these rings is not definitely known, but was probably five or six. The plates have an ornamentation similar to that of the carapace, except that the peripheral figures are, at least in most of the rings, confined to the anterior portion of each scute. In the hinder part of the tail the rings are but slightly movable, and of these there appear to be four, each of two rows of plates; the scutes have no sculpture, but are finely punctate and retain a number of conspicuous piliferous pits. A peculiarity of this genus is the abrupt termination of the tail-sheath, the tube being closed by a small, irregular plate.

The material for the study of the endo-skeleton is unusually complete in this genus. Besides numerous skulls and parts of the limbs, it comprises the beautiful specimen in the La Plata Museum, which was described by Mercerat ('91) and figured by Lydekker ('94, Pl. XXXII); a large part of the skeleton of *P. minor* found with the fine carapace shown in Plate XVII, and belonging to the American Museum of Natural History; finally the greater part of the skeleton of *P. australis* associated with the carapace figured in Plate XVIII, and now in the Princeton Museum.

Dentition (Plate XXIV, figs. 1–6, 14).—The dental formula is $\frac{8}{8}$, but in the premaxillary and corresponding part of the mandible are to be observed two or three small pits, indicating the presence of additional vestigial teeth, which were shed very early. This fact, which was first pointed out by Ameghino (87^b, 24), has been denied by Lydekker ('94, 47), but it occurs in too many specimens to be without significance. Of the functional teeth in the upper jaw, $^{\underline{1}}$ is the smallest, but it varies much in size and in its position with reference to the maxillo-premaxillary suture; in form it is either cylindrical or D-shaped, with major axis transverse and convexity turned forward. The next tooth, $^{\underline{2}}$, is always larger than $^{\underline{1}}$, but even more variable in size; it has an elongate elliptical shape and a feebly marked vertical groove on the inner side; $^{\underline{3}}$ is still larger and is made externally bilobate by a broad sulcus and on the inner side feebly trilobate by two shallow vertical grooves; $^{\underline{4}}$ is similar, but larger and with much more distinct lobation; $^{\underline{5}}$ is trilobate both internally and externally, but with much larger inner lobes; in many individuals a distinct vertical groove on the anterior face demarcates the antero-external from the antero-internal lobe and the postero-external lobe is invariably divided into two pillars by a shallow vertical groove. The remaining teeth, $^{\underline{6}}$, $^{\underline{7}}$, $^{\underline{8}}$, resemble $^{\underline{5}}$, but there is a progressive increase in the size of the external lobes, giving a more symmetrical shape to each succeeding tooth, though the inner lobes are the larger in all of them; the division of the postero-external lobe into two pillars is most distinct in $^{\underline{6}}$, less so in $^{\underline{7}}$, and frequently absent in $^{\underline{8}}$.

In the lower jaw $_{\overline{1}}$ is of very variable size and is either of subcylindrical or longitudinally elliptical shape; $_{\overline{2}}$ is larger, but likewise variable, sometimes differing notably on the two sides of the same jaw, it is longitudinally elliptical in shape and quite simple, or with a median vertical pillar on the inner side; $_{\overline{3}}$ is much larger and obscurely trilobate on the outer side, while $_{\overline{4}}$ is still larger and more distinctly lobate. The succeeding teeth $_{\overline{5}}$, $_{\overline{6}}$, $_{\overline{7}}$, $_{\overline{8}}$, are trilobate, both internally and externally, or they may be described as composed of three vertical prisms, without demarcating grooves between the inner and outer anterior and posterior lobes, nor is the postero-external lobe subdivided.

In structure all the teeth are alike and are made up of three kinds of tissue; the external wall of the tooth is dense and shining, probably of cement, with almost the appearance of enamel; internal to this and composing most of the substance of the tooth is a thick layer of soft dentine and in the middle of the grinding surface is a longitudinal ridge of vaso-dentine, which sends out transverse branches into the lobes. All the teeth are very high-crowned, giving great depth to the jaws.

Comparing the dentition of *Propalæohoplophorus* with that of *Glyptodon*, the most striking difference to be observed is the simplicity and small size of the anterior teeth in the former. In the Pampean genus all of the teeth except 1 are alike (and even 1 is but slightly less complex) and the crowns have a more symmetrical shape; each tooth is composed of three rhomboidal prisms, of which the inner and outer lobes are of subequal size, while the vertical grooves on the front and rear faces of the crown are wanting; the postero-external lobe is not divided into two pillars. Finally, in *Glyptodon* the ridges of vaso-dentine have a much more complex pattern, the transverse branches giving off numerous ramifications, which are either feebly indicated or entirely absent in the Santa Cruz genus.

Skull (Plates XXIII, XXVII).—The variability of the skull in this genus is decided and individuals that agree closely in almost every other detail of the exo- and endoskeleton often have skulls of quite different appearance and proportions. Perhaps some of these modifications will prove to be of specific value, but it will require much more extensive material than has yet been gathered satisfactorily to establish such a conclusion. In general, the skull has a considerable resemblance to that of *Glyptodon*, but there are many differences, most of which may be referred to the inordinate increase in the height of the teeth and consequent depth of the jaws in the Pampean type. In proportion to its length, the skull of the Santa Cruz genus is much lower and narrower, the alveolar portion of the maxillaries having attained no such development, the rostrum is relatively much longer and narrower and the forehead much less expanded, making the postorbital processes and constriction less conspicuous; the curious overhanging shelf within the orbit formed by the parietal and frontal is already indicated, but far less prominent. The occiput is relatively larger and is nearly at right angles to the plane of the upper teeth, while in *Glyptodon* it is inclined very steeply forward, so as to present almost dorsally, and at the same time the condyles are raised to a very high level; the occipital crest is more prominent in the Santa Cruz genus, but is not nearly so thick and massive; the zygomatic arches arise more anteriorly and lower down on the sides of the cranium and thus are less inclined in their course forward; the descending suborbital processes are much shorter and the ascending ramus of the mandible is very much lower.

In side-view, the upper profile of the skull rises slightly to the parietal eminence and thence descends more or less steeply to the end of the rostrum, with a convexity over the frontals produced by the sinuses, which varies much in prominence.

The basioccipital is relatively elongate and appears to form nearly all of the visible basicranial axis; it is stout and broad, and the posterior portion is very wide and deeply incised by the foramen magnum; the condyles are relatively small, sessile and semicylindrical; each articular surface is deeply invaded by a sulcus from the outer side. The foramen magnum is broad, but very low, presenting ventrally rather than posteriorly. None of the specimens displays the sutures between the ex- and supraoccipitals, but, as a whole, the occipital surface is low and wide and has a more or less distinct median ridge with a deep fossa on each side; paroccipital processes are entirely wanting. The periotic is quite largely exposed in the occiput and has a rugose surface, but forms no mastoid process other than a low, rough ridge; the anterior portion of the bone has the same peculiar fusiform shape seen in *Glyptodon*, tapering to a sharp edge. The tympanics have not been found. Little of the basisphenoid is exposed to view; the visible part is broad and thick, contracting anteriorly, while the ali- and orbitosphenoids are reduced to small proportions by the encroachment of the maxillaries.

The parietals are large and form nearly the entire roof of the cerebral fossa; most of their surface is very rough and is perforated by several large and conspicuous venous foramina. For their whole length, the parietals support a moderately prominent sagittal crest. The squamosal is low, but elongate, apparently articulating with the frontal; the glenoid cavity has already acquired the peculiar form seen in *Glyptodon*, being a slightly convex ridge, which presents obliquely downward and backward; there is no postglenoid process, but behind the cavity, so called, is a large, deep fossa, in the roof of which are venous foramina. The zygomatic process has a rather short and slender free portion, which extensively overlaps the jugal, ending in a rounded anterior projection, which fits into a notch of the jugal. The latter is a long, stout and laterally compressed plate, which extends posteriorly beneath the zygomatic process of the squamosal nearly to the glenoid cavity, and anteriorly is produced downward upon the great descending zygomatic process of the maxillary, though not reaching quite to its free end; the postorbital process is hardly more than an angulation. The lachrymal is large and rests upon the zygomatic process of the maxillary, articulating with the frontal and jugal; the foramen is large and conspicuous and placed well in front of the orbit.

The frontals are long and broad, slightly narrowed by the postorbital constriction and expanding over the orbits; the postorbital processes are very short, and the temporal ridges are hardly visible, though the sagittal crest is often continued over upon the frontals. The frontal sinuses are sufficiently developed to make the forehead convex, but there are great individual differences in the degree of prominence thus produced. In certain specimens, presumably old males, the inflation of this whole region is such as to suggest an incipient stage of the development which gives such a grotesque appearance to the facial region of the Pampean *Sclerocalyptus*. Within the orbit there is an oblique ridge upon the frontal, which passes downward and backward, ending in a broad, compressed, downward-projecting spine, which overhangs the optic foramen; in *Glyptodon* this ridge is very prominent.

The nasals are short and broad, though much longer than in the Pampean glyptodonts; they are convex transversely, nearly plane longitudinally, and, projecting beyond the premaxillæ, end in bluntly rounded tips. The anterior nares have much the same shape as in *Glyptodon*, but are somewhat smaller and broaden less toward the dorsal side. As in the latter genus, a stout bony septum divides the nasal passage into two parts and extends from the nasals to the hard palate. The premaxillaries are very small, but far less reduced than in the Pampean genera; the horizontal ramus is short, thin and weak and, with its fellow, forms a rounded anterior termination to the hard palate, and each is perforated by a very small incisive foramen; the ascending ramus is a narrow strip, which extends to the nasal, excluding the maxillary from the border of the anterior nares, while in all the Pampean genera it is widely separated from the nasal. The maxillary is very large, and, though attaining no such extraordinary proportions as in *Glyptodon*, is very long and deep; the preorbital portion, which is relatively much longer than in the latter, varies considerably in length in the different species and individuals; the zygomatic process forms a very long, descending plate, with its broader side turned forward and ending distally in a rounded border. In correlation with the increased depth of the jaws, this process is far longer in *Glyptodon*. The bony palate is very long and narrow and of nearly uniform width throughout; transversely it is concave, but longitudinally it is concave in front, convex and rising steeply behind. The extent of the palatines is not determinable in any specimen that I have examined. The posterior narial opening resembles that of *Glyptodon*, but is lower, and presents almost directly backward. The pterygoids form broad, rugose surfaces, without fossæ or hamular processes.

The mandible displays the curious features of the Pampean genera, but in a much less pronounced degree. The horizontal ramus is rather short, laterally compressed and deep, coössified at the symphysis, where the edentulous part of the alveolar border is flared outward to form the spout which is so characteristic of all the glyptodonts, but does not project so far in front of the premaxillæ as it does in the Pleistocene types. This feature is not visible in the specimen figured in Plate XXIII, fig. 1, the symphysis of which has been destroyed, but is well shown in Lydekker's plate ('94, Pl. XXXI). The ascending ramus is very broad and arises very far forward from the outer side of the horizontal portion, so that in side view the last two teeth are concealed from sight; it has a much smaller vertical extension than in *Glyptodon* and the condyle is not elevated nearly so high above the level of the teeth. The condyle itself is of a shape like that of the latter and presents obliquely forward in a similar way, but is much less massive, while the sigmoid notch is considerably deeper. Coronoid and angle are quite alike in the two genera, but the ventral border of the jaw rises much more suddenly to the ascending ramus in the Pampean type.

The cranial foramina present a number of interesting points. The infraorbital foramen is large and is double, at least in some individuals, the smaller opening being above and external to the larger (Plates XXIII, fig. 4; XXVII, 2). The optic foramen is remarkably small and is continued forward for some distance as a groove beneath the overhanging ledge of the frontal. Close behind the optic foramen is the foramen lacerum anterius and beneath the latter is a large opening, probably vascular, into the maxillary. The foramen rotundum is placed considerably behind the foramen lacerum anterius and is closely followed by the foramen ovale; this is an important difference from *Glyptodon*, in which, according to Huxley ('65), the foramina rotundum and lacerum anterius have a common opening. The loss of the tympanics has destroyed the foramen lacerum medium and eustachian canal in all of the specimens that I have examined, but the foramen lacerum posterius is still visible. The condylar foramen is large and is placed so near to the condyle as to be partly concealed in the ventral view, and the stylo-mastoid foramen is a conspicuous opening through the mastoid portion of the periotic.

Vertebral Column, Ribs and Sternum (Plates XXII, XXV).—Ameghino states ('94^a, 170) that in the young animal the vertebræ are all separate. In the adult, however, the concentration is almost as complete as in the Pampean genera. The neck is very short, intermediate in its proportions between that of *Sclerocalyptus* and that of *Glyptodon*. The atlas, which is free, is shaped much as in the former and in the larger armadillos, being broad, but very short, with the anterior cotyles projecting well in front of the neural arch, which is conspicuously perforated by the foramina for the first pair of spinal nerves; the neural spine is almost obsolete and the inferior arch narrow and very slender; as in *Proeutatus*, the vertebrarterial canal enters above the posterior cotyle and opens upon the side of the vertebra; the transverse processes are very small, hardly more than ridges on the postero-external angles.

The atlas is followed by a compound vertebra made up of the axis and the three succeeding cervicals (Plate XXV, fig. 1) completely fused together, but with lines of suture remaining on the ventral side of the centra. The axis has a broad, much depressed centrum, low and broad facets for the atlas and a short odontoid process, which is broad at the base, but tapers rapidly to a blunt point; the neural canal is large and the spine is a high, narrow, laterally compressed plate; the vertebrarterial canal opens in the base of the transverse process, immediately behind the anterior cotyle. The other elements of the compound bone have very short and broad centra, which are so much depressed as to be merely thin, transversely arched plates; the neural arches are quite high, but these vertebræ appear to have no spines; zygapophyses are visible only on the hinder part of the fifth cervical; the transverse processes of all the vertebræ are fused together into a very long and heavy mass, which is thickened and rugose at the distal end, and has three foramina on the ventral side. The sixth cervical is free, but similar in form to the fifth, and in some specimens the neural arch is reduced to a mere bony thread, and a very small spine may or may not be present; the zygapophyses are large and are so closely approximated that the anterior one extends over the posterior one of the same side; the transverse process is long and thin and extends directly outward; the anterior face of the centrum is transversely concave and extends around the postero-external angles of the preceding vertebra, quite as in *Proeutatus*.

As in *Glyptodon*, the last cervical is fused with the first two thoracics; it has a longer and somewhat wider centrum than the sixth, with facets for the first pair of ribs; the neural arch is extremely slender and the spine is absent.

The number of thoracic vertebræ appears to be eleven, of which the first two are coalesced with the last cervical, the third, fourth and sometimes the fifth, are free, while the remaining six coalesce with each other and with the first lumbar to form the "dorsal tube" (Plate XXV, fig. 2). The first and second thoracics have centra which are short, broad and depressed, though less so than those of the cervicals; the second is quite opisthocœlous; the compound neural spine is low, but broad, and much thickened at the free end; the transverse processes are long and heavy and bear large facets for the tubercles of the ribs. In the dorsal tube, which has a longitudinal curvature, the centra are longer, narrower and thicker, increasing in size posteriorly, with kidney-shaped, slightly opisthocœlous faces; in the anterior part of the tube the neural canal is very small, but enlarges much posteriorly; the coalesced neural spines form a prominent and continuous ridge, with thin free border, while in the Pampean genera this border is very thick; another difference from the latter is in the separateness of the transverse processes, which are much elevated and thickened at the distal end and are connected only by a very thin ridge of bone which runs along their mesial sides.

The lumbars are seven or eight, the first of which forms part of the dorsal tube, while the others have united together and with the sacrum to form a second tube (Plate XXV, fig. 3); between the two is a movable joint, the first lumbar with post-zygapophyses and the second with prezygapophyses, both well developed, and, it is especially interesting to note, a pair of accessory articular processes. The centra of the lumbar vertebræ become larger, but more depressed, and the neural canal enlarges posteriorly; on the last three is a pair of prominent and parallel ventrolateral keels; the metapophyses, when present, are high and thin, but they are absent from the last three lumbars; the neural spines form a high, thin ridge, which rises far above the level of that of the dorsal tube; transverse processes are lacking.

The sacrum is composed of seven or eight vertebræ, of which the anterior two are connected with the ilia; the coalesced centra form an arched, slender, almost rod-like body, though the last one is much thickened for the attachment of the heavy tail; transverse processes are obsolete on most of the sacral vertebræ, but on the last two or three they are very long, broad and plate-like, and their distal ends are fused with the ischia. The fused neural spines of the sacrum form a high, thin and arched crest and are continuous with the similar crest of the lumbars; large postzygapophyses are present on the last vertebra.

The caudal vertebræ (Plate XXV, figs. 4–10) probably did not exceed twelve or thirteen in number; in the La Plata skeleton eleven are preserved in continuous series and apparently only the terminal one is missing. In its proportions the tail resembles that of *Glyptodon* rather than that of the other Pampean genera, being short and massive and tapering rapidly. The first caudal has a large, broad and much depressed centrum; the neural arch is quite short antero-posteriorly, and very high dorso-ventrally, but the canal is very small and the spine low; the zygapophyses are very largely developed, extending much in front of and behind the centrum, especially the anterior pair, which are surmounted by prominent, rugose metapophyses; the transverse processes are immensely long, extending across the full width of the posterior pelvic opening, and somewhat thickened at the ends, but not articulating with the ischia. The second caudal is very similar to the first, but has a narrower, less depressed centrum, and slightly shorter, decidedly more slender transverse processes. In the third caudal the centrum is nearly as long as that of the second, but is more cylindrical in shape; the neural arch and zygapophyses are somewhat reduced, and the transverse processes are considerably shorter than those of the second vertebra; at the distal end, they are strongly decurved and have roughened faces for the attachment of the first ring of the tail-sheath. The fourth vertebra has a still more slender and cylindrical centrum, much smaller neural arch and zygapophyses and shorter, though strongly decurved and expanded transverse processes.

The fifth caudal displays a comparatively sudden diminution in the size of all the processes, but the transverse processes are still large and decurved. In the sixth the neural arch is further reduced, and the transverse processes are shorter, but are still prominent and decurved and have broad external faces. In the seventh vertebra the transverse processes are straight and very much smaller. The succeeding vertebræ diminish rapidly in size, and the eleventh is very small; in all of them the centra are cylindrical, somewhat contracted in the middle, and the various processes are rudimentary.

Chevron-bones are well developed; in the anterior region (Plate XXV, fig. 8), these bones are long, slender and laterally compressed, with the proximal end expanded and enclosing a triangular canal, and with the distal end furcate. Posteriorly the chevrons become shorter and wider and in the middle part of the tail (fig. 9) they are rather short, thin plates, much expanded in the antero-posterior dimension, broadened at the proximal end and perforated by a small circular canal; from the middle of the distal, or ventral border is given off a pair of prominent, curved processes, one on each side. In the hinder region of the tail (fig. 10), the chevrons are very small and canoe-shaped, resembling those of the armadillos.

The ribs are already characteristically glyptodont; the first rib is short, broad and plate-like, presenting directly forward and with distal end fused with the presternum. The succeeding ribs are broad, but very thin and laterally compressed; the proximal end forms a hammer-shaped expansion which, at least in the anterior part of the thorax, bears three distinct facets for the vertebræ. The sternal ribs are stout and articulate with the vertebral ribs by well-developed synovial joints; in relative size and shape they strikingly resemble those of the armadillo *Proeutatus*.

Of the sternum, the La Plata skeleton retains the manubrium, the last segment of the mesosternum and the xiphisternum. The manubrium is short, very broad and thin, and its lateral borders are fused with the first pair of ribs; the anterior margin is somewhat concave, with a pair of prominent tubercles, which seem to indicate the presence of clavicles, though none have yet been found in association with any of the specimens. The last segment of the mesosternum is short and thick and has two pairs of concave facets for the sternal ribs. The xiphisternum is very long, depressed and thin, quite broad anteriorly, but tapering behind to a blunt and slightly upcurved point.

Appendicular Skeleton.—To a certain extent, the limbs of the genus are intermediate in character between those of the armadillos and those of the Pampean glyptodonts, and though decidedly nearer to the latter, are yet much less massive. The fore-limb is considerably shorter than the hind, the relative lengths of the two pairs being almost exactly as in *Glyptodon*.

The scapula (Plate XXVI, fig. 1) differs from that of the Pampean genera in its narrowness and consequent resemblance to that of such an armadillo as *Proeutatus;* the glenoid cavity is elongate antero-posteriorly, narrow transversely; the neck is very broad and the coraco-scapular notch hardly indicated; the pre- and postscapular fossæ are of nearly equal size, but of different shape, and the postero-superior angle of the blade is more like that of *Glyptodon* than the slender, sickle-shaped process seen in *Sclerocalyptus;* the spine is very prominent and its free border is very wide and recurved, much more like that of *Proeutatus* than that of the Pampean genera; the acromion is long and incurved and there is a large metacromion; the posterior spine-like ridge is distinct from the glenoid border and much more prominent than in the later glyptodonts. The coracoid is large, thickened at the end and indistinguishably fused with the scapula.

The humerus (Plate XXVI, fig. 2) is long and slender, with small hemispherical head, which presents proximally more than posteriorly; the external tuberosity is low, broad and massive, with an articular facet for the acromion; the inner tuberosity is small and the bicipital groove is deep and narrow; the deltoid ridge is a large and very prominent, shield-shaped area, which projects more than in *Sclerocalyptus*, less than in the Santa Cruz armadillos; the supinator ridge is also prominent and extends very far proximally; the external epicondyle is very small, while the inner one is large and is perforated by a large foramen, as in *Sclerocalyptus*, *Panochthus* and *Dœdicurus*, but not in *Glyptodon;* the trochlea is wide and low, with a convexity for the head of the radius and prominent inner flange; the anconeal fossa is small and shallow.

The radio-cubital arcade is longer and wider than in the Pampean genera and there is no such rugosity or interlocking of the interosseous crests as occurs in them. The radius (Plate XXVI, fig. 4) is very short, hardly more than one half as long as the humerus, and quite slender, closely resembling that of *Proeutatus* in form; the head is transversely expanded and has three facets for the humerus, a median concavity and two lateral, nearly plane surfaces, quite as in the last named genus; the facet for the ulna is a broad, slightly convex band, which occupies nearly the whole posterior side of the head; the shaft is slender and laterally compressed, thickening gradually to the broad distal end; the carpal surface is large, concave and undivided; on the inner side of the distal end is a prominent tubercle for ligamentous attachment.

The ulna (Plate XXVI, fig. 3) is much larger than the radius in every dimension; the olecranon is less elongate than in the armadillos, tapering but slightly to the proximal end, which is moderately thickened and incurved; the inner side of the process is deeply grooved; the sigmoid notch is broad, rather shallow and not oblique to the long axis of the bone, on the inner side it extends around the head of the radius and beneath the humeral trochlea; the shaft is short, stout, straight and of nearly uniform diameter, except for the interosseous crest on the distal half and a moderate expansion of the distal end, which bears a large facet for the pyramidal and a small one for the pisiform.

The carpus (Plate XXVI, fig. 5) is broad and very short proximodistally, but the bones have not acquired the massive, block-like shapes seen in the Pampean genera. The scaphoid is the smallest bone of the proximal row, and is narrow, but very thick palmo-dorsally; on the ulnar side is an oblique projection, which extends beneath the lunar to a contact with the magnum; on the distal end is a large, saddle-shaped facet for the trapezoid and a much smaller one for the trapezium. The lunar is low, broad and very thick, with a massive, rugose tubercle projecting from the palmar face; the radial facet is very convex and descends well upon the dorsal side; distally, the lunar rests upon the scaphoid and magnum, but has also a small contact with the unciform. The pyramidal is very broad, but not so thick as the lunar, with which it is in close contact; the facet for the ulna is large and slightly concave, but does not cover the whole proximal end of the bone, being separated by a considerable space from the radial facet of the lunar; the pisiform facet is a narrow band. The pyramidal rests upon the unciform, but projects externally beyond it and bears a facet for metacarpal V, and on the ulnar border is an additional facet, which was doubtless for just such an accessory ossicle as is found in the manus of *Sclerocalyptus.* The pisiform most resembles that of *Glyptodon*, but is much more slender; it is small, curved and laterally compressed, tapering to a blunt point at the free end and transversely expanded at the proximal end. The trapezium and trapezoid are not known. The magnum has a small exposed dorsal face, which is of nearly rectangular shape; the proximal end is covered by the lunar and the contact with the scaphoid is entirely lateral; the distal end has a large, saddle-shaped facet for metacarpal III, and a very small surface for II. The unciform is somewhat smaller than the pyramidal and has but a small palmar tubercle; distally it is covered almost entirely by the large facet for metacarpal IV, that for V being very small; metacarpal III also has a contact with the unciform, which is very small dorsally, but grows larger toward the palmar side, being incised in the bone in a curious way.

No metacarpals of this genus have yet been found and the number of digits is therefore uncertain, but there seems to be no reason to doubt that the manus, like the pes, was pentadactyl.

The only phalanges of the manus that I have seen are two belonging to the La Plata skeleton, one of which is an ungual; this is elongate, tapering and bluntly pointed, without cleft at the distal end, and with very massive and rugose subungual process; in shape it most resembles that of the second digit in the manus of *Sclerocalyptus.*

As Lydekker has pointed out ('94, 46), the most characteristic feature of the pelvis is the fact that the ilium and ischium have their long axes more nearly in the same straight line than is the case in the Pampean genera, and this reduces the vertical diameter of the sacro-sciatic foramen. Despite this difference, the pelvis is thoroughly glyptodont in appearance and structure; the ilium has a rather broad, antero-posteriorly compressed peduncle, expanding into a moderately wide anterior plate, which presents forward and is indistinguishably fused with the sacrum; the crista is not much thickened and does not display the rugosities for the support of the carapace, which are so strikingly shown in the larger and later genera. The ischium has a slender, laterally compressed peduncle, expanding behind into a very large vertical plate, which rises dorsally well above the level of the sacrum and ends in a thick, rugose border for the support of the carapace; apparently, there is no tuberosity. The acetabulum is large and deeply concave and has a small, deep and nearly circular pit for the round ligament, which partially divides the articular surface into two parts, a large anterior portion and a narrow posterior prolongation. The pubis is a slender, laterally compressed rod, which is relatively longer and thicker than in *Sclerocalyptus* and much less reduced than in *Glyptodon*. As in the Pampean genera, the pubis arises from the inner side of the ilium in a very characteristic fashion. I have seen no specimen in which the pubis is quite complete, and it is therefore impossible to determine whether the two formed a symphysis; apparently they did not, for the two bones diverge ventrally, though there may have been a narrow cross-connection, as in *Glyptodon*. Near the proximal end of the pubis and somewhat above the level of the acetabulum, arises a very prominent, rugose and hook-like process, which, according to Burmeister, is peculiar to this order, but occurs also in some of the Santa Cruz Gravigrada. The obturator foramen is long and very narrow, but relatively not longer than in *Glyptodon*.

The femur (Plate XXVI, fig. 6), as has been pointed out by Ameghino ('94^a, 170) and Lydekker ('94, 46), differs decidedly from that of the Pampean genera and retains considerable resemblance to that of the armadillos; among the former, it is the femur of *Sclerocalyptus* which most resembles that of the present genus, which is true of the other limb-bones also. The head is small, sessile, not very strongly convex, presenting proximally rather than inward, and inclined slightly forward; the sulcus for the round ligament is a shallow pit on the postero-internal side of the head and but slightly invading the articular surface; the great trochanter is large, rising far above the head, but is not nearly so broad as in the Pampean types; the digital fossa is completely obsolete; the second trochanter is not very prominent, but extends as a roughened ridge for some distance down the inner side of the shaft; the third trochanter is much more like that of one of the large Santa Cruz armadillos than one of the later glyptodonts, and its position is intermediate between these two extremes; it is a prominent, antroverted hook, situated below the middle of the shaft and therefore more distal than in the armadillos, much more proximal than in the Pampean glyptodonts. The shaft is proximally broad, much compressed antero-posteriorly and has a nearly flat posterior surface; from this proximal expansion the shaft contracts downward, becoming cylindrical above the third trochanter, and thickening and widening moderately at the distal end; this elongate and slender shaft is in very striking contrast to the extremely massive character of the bone in the great Pampean genera. The rotular groove is broad and quite deep, with raised and distinct internal and very low external border; a small, but well-defined suprapatellar fossa is sometimes, but not always present; the condyles are small and of unequal size, the inner one projecting more both posteriorly and distally, but there is no such difference as in *Sclerocalyptus;* the inner condyle is regularly rounded, while the outer one rises into a blunt, but prominent ridge.

The patella does not closely resemble that of any of the Pampean genera; it is rather small, and though quite thick, is much less so than in *Sclerocalyptus* or *Panochthus*, while it is not so flattened as in *Glyptodon*, nor has it the external process seen in the latter.

The leg-bones (Plate XXVI, fig. 7) are coössified at the two ends, widely separate elsewhere; they have considerable resemblance to those of *Proeutatus*, especially in front view, but are relatively shorter and heavier. As compared with the femur, the tibia has nearly the same relative length as in *Sclerocalyptus* and is much more elongate than in *Glyptodon;* the proximal end is broad and thick and has a bifid spine produced by the elevated mesial borders of the widely separated condyles, of which the internal is larger and more concave and stands at a much lower level, while the external one is slightly convex and has a faintly marked groove for the ridge on the outer femoral condyle. Except at the distal end, the shaft is much compressed laterally and plate-like, very thick antero-posteriorly and arched inward and forward; at the distal end, these proportions are reversed; the cnemial crest is very prominent and is continued down the whole length of the shaft, ending on the internal malleolus; two interosseous crests are present, one posterior, which is prominent near the proximal end, dying away below the middle of the shaft, the other anterior and, for most of its length, a mere linea aspera, but becoming prominent distally and uniting with a corresponding crest of the fibula. The astragalar surface has the external condyle larger and deeper than the internal; the intercondylar ridge is broad and low, but gives off an elongate, tongue-like process from the hinder border, separated by a deep sulcus from the much-reduced internal malleolus.

The fibula is likewise much compressed and plate-like, but very thick antero-posteriorly, especially near the proximal end; the distal end is massive, though not very broad, and terminates in a heavy, projecting malleolus, which articulates with the astragalus but not with the calcaneum.

The pes (Plate XXVI, fig. 8) is short and very heavy, though far from being so massive as in the Pampean genera, among which it most resembles that of *Glyptodon*. The astragalus has a short and very broad trochlea, which is but moderately grooved and is made asymmetrical by the larger size of the external condyle; the neck is very wide, but much narrower than the trochlea, and ends in a depressed, convex head; the navicular facet is very large and is reflected far up upon the plantar side of the neck; the external calcaneal facet is large and but slightly concave, while the sustentacular facet is smaller and nearly plane.

The calcaneum has a much compressed and rather slender tuber, which diminishes in dorso-plantar diameter toward the proximal or free end and has a broadening of the plantar border, especially on the inner side; the tendinal sulcus at the free end is shallow and confined to the plantar aspect; the sustentaculum is prominent and very heavy; the cuboid facet is large and slightly concave, and prominent tubercles arise from its plantar and fibular sides. There is no contact with the fibula.

The large navicular is distinctly more like that of the armadillos than is the corresponding bone of the Pampean genera, being low on the dorsal side, but rising high proximally on the plantar, and from the latter side arise two very large, hook-like processes; of the three distal facets for the cuneiforms, the external one is large and the median very small.

The entocuneiform also is more armadillo-like than that of the Pampean genera; it is relatively large, especially in the dorso-plantar and proximo-distal diameters and distally it not only articulates with the first metatarsal, but also quite extensively with the second.

The mesocuneiform is very small and is proportionately more reduced than in the Pampean types, except *Sclerocalyptus;* its only considerable diameter is the dorso-plantar and the exposed faces are nearly square.

The ectocuneiform is very large on the dorsal side, contracting to a blunt edge on the plantar; the bone is placed obliquely in the tarsus and distally articulates with the second and third metatarsals. In the Pampean genera the ectocuneiform is relatively very much broader and may extend over upon the head of metatarsal IV.

The cuboid is short, especially upon the fibular side, which is owing to the obliquity of the calcaneal facet; though short, the cuboid is broad and thick and has a massive process from the plantar face. In its proportions this cuboid is intermediate between that of *Sclerocalyptus* and that of *Glyptodon;* in the former it is longer and narrower, while in the latter it is far wider and shorter.

The metatarsus consists of five members, all of which are short and heavy, though less so than in the Pampean genera. Metatarsal I is much the shortest of the series and its breadth nearly equals its length; the distal trochlea is reflected far over upon the plantar face and is grooved, but has no keel.

Metatarsal II is almost twice as long as I, but very short and heavy; its broad proximal end articulates with all three of the cuneiforms; the shaft is short, broad and very thick, somewhat contracted near the proximal end and widening distally; the trochlea extends far over upon both plantar and dorsal faces, and has a slight median groove and a distinct plantar carina.

Metatarsal III is somewhat longer and considerably stouter than II; it has a broader head, a shaft of more uniform width, and a similar trochlea.

Metatarsal IV is of nearly the same length as II, but has a more rounded shaft and shorter trochlea.

Metatarsal V is extremely short and of only moderate thickness; its trochlea is slightly convex.

The phalanges are likewise very short and broad, especially those of the median three digits (II, III, IV) which are much larger in every dimension than the laterals (I and V). In the latter the unguals are relatively long and bluntly pointed, but in the median three they are very broad and hoof-like.

Restoration (Plate XXII).—The general appearance of the skeleton suggests a small and very lightly built *Glyptodon;* the shape of the skull, the length of the neck, the curvature of the back, the proportions of the tail, and the relative lengths of the fore- and hind-limbs most nearly resembling those of the last named genus. On the other hand, the bones of the limbs and feet have the more slender proportions seen in *Sclerocalyptus*, to which many resemblances of detail may be observed. A notable difference from the Pampean genera is in the much smaller vertical diameter of the head and the far less elevated position of the occipital condyles, in consequence of which the skull depends less below the level of the neck. It is unnecessary to repeat here the details of resemblance and difference, to which attention has been called in the foregoing description. The most significant feature is the unmistakable similarity to the armadillos, to which group the present genus is distinctly nearer than are the great Pampean types.

Relationships.—Mercerat ('91, 33) and Lydekker ('94, 47) have pointed out the many resemblances between this genus and the later *Plohophorus.* Lydekker expresses the opinion, "that *Propalæohoplophorus* was either the direct ancestor of *Plohophorus*, or was very nearly related to such ancestor. Possibly the ancestral form may have been another species, without imbricating bands in the margin of the carapace. The genus was likewise not improbably related to the ancestral stock from which *Glyptodon* originated" (*loc. cit.*).

It seems altogether likely that the Santa Cruz genus was very near to the common stem whence all the Pampean types arose by divergent development, but none of the latter, so far known, appears to be directly descended from it. On the other hand, a North American representative of this series very probably persisted into the Pleistocene. The fine carapace collected in Texas by Mr. Gidley, for the American Museum of Natural History, which Osborn has described ('03, 489) under the name of *Glyptotherium texanum*, has associated with it a tail-sheath of quite similar character to that of *Propalæohoplophorus*, but no representative of this series has yet been found in the Pleistocene of South America. It is a highly suggestive fact that, in those respects in which the Santa Cruz genus departs from the later and more specialized glyptodonts, it approximates the armadillos. As we trace the two orders back in time, they converge toward a common type and it seems abundantly clear that both were derived from the same stock.

Species.—Ameghino has distinguished three species of this genus, *P. australis*, *P. incisivus* and *P. minor*, and to these Mercerat has added a fourth, *P. aratræ*. The first two shade into each other by such imperceptible gradations that it seems impossible to separate them; it is true that from a considerable series of skulls typical examples may readily be selected which are quite distinct, but the number of intermediate specimens quite equals that of the typical ones. *P. aratræ* is very imperfectly known, but there seems to be no reason for separating it from *P. australis*. On the other hand, *P. minor* is apparently well distinguished; at all events, the transitions are neither so numerous nor so closely connected.

PROPALÆOHOPLOPHORUS AUSTRALIS (Moreno) Ameghino.

(Plates XVIII, XXI, Fig. 1; XXII, XXIII, XXIV, Figs. 1–6; XXV, Figs. 1, 5–10; XXVI, Figs. 2–8.)

Hoplophorus australis Moreno; Patagonia, Resto de un antiguo Continente hoy Submergido, 1882, p. 26.
Propalæohoplophorus australis Amegh.; Enum. sistem., 1887, p. 24.
Propalæohoplophorus incisivus Amegh.; Ibid.
? *Propalæohoplophorus aratræ* Mercerat; Rev. del. Mus. de La Plata, T. II, 1891, p. 40.

This species is quite variable in regard to the form, size and position of the anterior teeth, the length of the rostrum, the prominence of the frontal sinuses, and such minor details, but in essentials the species is very constant. In the posterior upper teeth the division of the postero-external lobe is relatively faint. The skull is large in proportion to the size of the animal, narrow and elongate, the convexity of the forehead is but moderate and the rostrum, though variable, is always relatively long, so that the upper profile of the skull makes a long and gradual descent from the parietal eminence to the end of the muzzle; the rostrum contracts anteriorly and has quite a deep fossa on the maxillary just in front of the zygomatic process. The zygomatic arches are long, but do not extend out very far from the sides of the cranium, making the temporal openings narrow and elongate, while the ventral border of the arch has a gentle slope downward and forward; the suborbital process of the jugal and maxillary is rather short and has an almost vertical direction; *i. e.*, at right angles to the plane of the upper teeth; the jugal has hardly any trace of a postorbital process, but that of the frontal is quite distinct. The occipital condyles are usually almost sessile and project downward rather than backward, though there is considerable variation in this respect. The infraorbital canal is sometimes single and sometimes double, a difference which appears to be entirely individual.

The great majority of the skulls of this species which have been collected have suffered more or less distortion from pressure and they often have a very different appearance in accordance with the direction in which this pressure was applied, whether it was vertical, horizontal, or oblique. The bones of the skeleton, which have been described in the account of the genus, appear to be almost exactly alike in the two species. Whether any constant difference occurs in the structure of the exoskeleton, is still uncertain, for the number of fairly complete carapaces which have been collected is still too small to show whether the remarkable differences between them are specific or merely individual.

The following measurements were made from No. 15,212 in the Princeton collection; this is a fine specimen, with most of the carapace and a large part of the skeleton, which agrees closely in size with the La Plata skeleton. It was collected by Mr. Hatcher at Corriken Aike.

MEASUREMENTS.

Upper dentition, length	.094	$\underline{8}$, length	.0105
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.003	" width	.007
" width (*i. e.*, transverse diameter)	.0035	Skull, length in median basal line	.144
$\underline{2}$, length	.0055	" extreme length	.160
" width	.004	Cranium, length to anterior rim of orbit	.110
$\underline{3}$, length	.009	Occiput, height	.041
" width	.004	" width at base	.064
$\underline{4}$, length	.011	Zygoma, length	.080
" width	.0045	" length of suborbital process	.046
$\underline{5}$, length	.012	Skull, width over suborbital processes	.100
" width	.006	Palate, length in median line	.104
$\underline{6}$, length	.0125	" width at $\underline{1}$	.018
" width	.007	" " " $\underline{8}$	.024
$\underline{7}$, length	.0125	Rostrum, length	.040
" width	.007	" width at infraorbital foramen	.048

Rostrum, width at anterior end	.035
Mandible, depth below $_{\overline{3}}$	.029
" " " $_{\overline{6}}$	.031
Cervical mass, length	.034
Axis, breadth of anterior face	.046
Sixth cervical, length of centrum	.006
" " width of centrum	.048
Cervico-thoracic mass, length	.026
Seventh cervical, width of anterior face	.044
Second thoracic, width of posterior face	.036
Last sacral, width across transverse processes	.164
Humerus, length	.162
" width of proximal end	.034
" " over epicondyles	.050
Radius, length	.088
" width of proximal end	.0235
" " " distal end	.026
Ulna, length	.128
" " of olecranon	.043
" width at sigmoid notch	.026
" " of distal end	.020
Carpus, breadth	.038
Pelvis, length	.272
Ilium, length	.135
Ischium, length	.137
Femur, length from head	.198
" " " great trochanter	.222
" width of proximal end	.073
Femur, width of distal end	.054
Tibia, length	.130
" width of proximal end	.052
" " " distal end	.031
Fibula, length	.128
" thickness of proximal end	.032
" " " distal end	.023
Calcaneum, length	.051
" " of tuber	.030
" width of proximal end	.022
" " " distal end	.017
Astragalus, length	.030
" width of trochlea	.027
" " " distal end	.017
Metatarsal I, length	.012
" " width of proximal end	.008
" " " " distal end	.008
Metatarsal II, length	.023
" " width of proximal end	.013
" " " " distal end	.012
Metatarsal III, length	.028
" " width of proximal end	.0165
" " " " distal end	.013
Metatarsal IV, length	.024
" " width of proximal end	.011
" " " " distal end	.0135
Metatarsal V, length	.0135
" " width of proximal end	.0195
" " " " distal end	.011

PROPALÆOHOPLOPHORUS MINOR Ameghino.

(Plates XVII, XXIV, Fig. 14; XXV, Figs. 2–4; XXVI, Fig. 1; XXVII.)

Propalæohoplophorus minus Amegh.: Rev. Argent. de Hist. Nat., T. I, 1891, p. 326.

The type of this species is a lower jaw and Ameghino's original description of it as follows: "Size distinctly smaller than *P. incisivus*; symphyseal region narrower and more prolonged; molars more compressed and of more slender shape; length of the eight lower teeth, 89 mm.; height of the horizontal ramus below the fourth tooth, 30 mm.; below the hinder part of the sixth, 41 mm." (*loc. cit.*).

To this species I refer the beautiful specimen, No. 9197, collected by Mr. Barnum Brown for the American Museum of Natural History. The specimen consists of the carapace, nearly complete (Plate XVII); of the skull (Plate XXVII), unfortunately without the mandible; of the dorsal and lumbo-sacral tubes (Plates XXV, figs. 2, 3); nearly all of the tail; part of the scapula (Plate XXVI, fig. 1); the humerus (fig. 2), radius, pelvis, and femur. The absence of the mandible, the only known part of the type, makes the reference to this species somewhat uncertain, but there can be little doubt, I think, that this individual represents a species distinct from *P. australis;* that it belongs to *Propalæohoplophorus* is not open to question.

The carapace (Plate XVII) is 529 mm. long on the ventral border and about 492 mm. on the median dorsal line, both measurements being taken in a straight line, not following the curvature of the shell; the transverse width is greatest about the first movable band of plates and is here 378 mm. In the composition of the carapace and in the shape and ornamentation of its plates, no significant difference from *P. australis* is observable.

Of the teeth (Plate XXIV, fig. 14) only $^{\underline{1}}$, $^{\underline{2}}$, $^{\underline{7}}$ and $^{\underline{8}}$ are preserved, but the shape of several of the others may be inferred from the uninjured alveoli; $^{\underline{1}}$ is very small, transverse and of D-shaped cross-section; $^{\underline{2}}$ is also small, with kidney-shaped masticating surface and non-lobate. The empty socket of $^{\underline{6}}$ shows that the division of the postero-external lobe was very marked, much more pronounced than in the preceding species and approximating the condition of *Cochlops.* The same is true of $^{\underline{7}}$, which is in place, and which is further characterized by the depth of the median vertical groove of the anterior face, dividing the anterior prism into internal and external lobes more distinctly than in *P. australis.* The last tooth, $^{\underline{8}}$, has a similar deep groove on the anterior face, but the postero-external lobe is single.

The skull (Plate XXVII), which is not quite complete, is yet remarkably free from the distortion which has so altered and disguised the appearance of most of the known glyptodont skulls from the Santa Cruz beds. It is relatively small and of proportions quite notably different from those of *P. australis*, as will be seen on comparing Plates XXIII and XXVII. The most striking differences from the skull of the preceding species are as follows: the whole skull is shorter and broader, with relatively more elongate and wider cranium and decidedly shorter face; the occiput is both higher and broader and its crest much more regularly curved, the margins of the foramen magnum are more prominent, giving the canal a more tubular shape; the condyles are larger and more elevated above the plane of the teeth; the forehead is much more inflated and rounded by the development of the frontal sinuses and has no depression in the median line; the descent of the upper profile from the forehead to the muzzle is very much steeper and more abrupt and the postorbital constriction is better marked, while the dorso-ventral diameter of the skull is everywhere greater; the rostrum is much shorter, broader and less tapering, and there is no preorbital fossa on the maxillary; the vertical height of the posterior nares is very much greater (cf. Plate XXIII, fig. 5 with Plate XXVII, fig. 1). The zygomatic arches are shorter, but curve out more boldly from the sides of the skull, making the temporal foramina wider; the dorso-ventral breadth of the jugal is greater, its ventral border is much more steeply inclined downward and forward and its postorbital process is much better developed, while that of the frontal is less so; the great descending suborbital process of the jugal and maxillary is decidedly longer and has a distinct backward inclination. The hard palate is relatively broader and is much less deeply incised by the posterior narial opening.

The bones of the skeleton agree in almost every detail with those of the preceding species.

MEASUREMENTS.

Upper dentition, length	.094
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.0035
" width (*i. e.*, transverse diameter)	.005
$\underline{2}$, length	.0065
" width	.0045
$\underline{7}$, length	.012
" width	.007
$\underline{8}$, length	.010
" width	.007
Skull, length in median basal line	?.130
" extreme length	?.146
Cranium, length to anterior rim of orbit	.107
" width at postorbital constriction	.042
Cranium, width across zygomatic arches	.112
Zygomatic arch, length	.069
" " " of suborbital process	.050
Occiput, height	.042
" width at base	.065
Rostrum, length from infraorbital foramen	?.036
Rostrum, width at infraorbital foramen	.047
Palate, length in median line	?.100
" width at $\underline{1}$	.017
" " " $\underline{8}$	.023
Dorsal tube, length	.146
Sixth thoracic, width of anterior face	.026
First lumbar, width of posterior face	.0225
Second " " " anterior face	.023
Second caudal, length of centrum	.0325
" " width of anterior face	.0225
" " height (including centrum)	.052
Second caudal, width over transverse processes	.130
Third caudal, length	.036
" " width of anterior face	.023
" " " over transverse processes	.115

Fourth caudal, length	.035
" " width of anterior face	.020
" " " over transverse processes	.083
Fifth caudal, length	.036
" " width of anterior face	.020
" " " over transverse processes	.058
Sixth caudal, length	.035
" " height	.030
" " width of anterior face	.018
" " " over transverse processes	.024
Seventh caudal, length	.033
" " width of anterior face	.017
" " " over transverse processes	.036
Eighth caudal, length	.028
" " width of anterior force	.013
" " " over transverse processes	.022
Ninth caudal, length	.025
" " width of anterior face	.012
" " " over transverse processes	.018

Tenth caudal, length	.022
" " width of anterior face	.010
" " height	.007
" " width over transverse processes	.015
Scapula, breadth of neck	.052
" length of glenoid cavity	.032
" width " " "	.021
Humerus, length	.159
" width of proximal end	.039
" " " distal trochlea	.034
" " over epicondyles	.052
Radius, width of distal end	.029
" thickness of distal end	.020
Pelvis, length	.281
Ilium, length	.151
Pubis, length	.124
Acetabulum, antero-posterior diameter	.035
" dorso-ventral diameter	.030
Obturator foramen, length	.081
Femur, length from head	.210
" " " great trochanter	.225
" width of proximal end	.081
" " " distal end	.056

(N. B.—As the anterior margin of the premaxillaries is broken, the measurements involving this region are somewhat uncertain, but the inaccuracy must be very slight.)

COCHLOPS Ameghino.

(Plates XIX, XX, XXI, Fig. 5; XXIV, Figs. 12, 13; XXVIII, Figs. 1–4.)

Cochlops Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent., 1889, p. 792.

Asterostemma Amegh., in part; Ibid., p. 822.

Propalæohoplophorus Mercerat, in part; Rev. del Museo de La Plata, T. II, 1891, p. 28.

Propalæohoplophorus Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 45.

Although closely allied to *Propalæohoplophorus*, this is nevertheless a well-defined genus.

Exoskeleton.—The cephalic shield (Plate XXI, fig. 5) is, like that of the preceding genus, made up of separate plates, which, however, are smaller and more numerous, about 30 in all, and are arranged according to a definite plan. The posterior and larger part of the shield is formed by two transverse bands of four plates each, with the median pair of each composing a group of four large plates, the largest of the entire structure; next in front is a transverse band of five plates, three of moderate size and on each side of this group a very small marginal plate. The anterior portion of the shield, which is considerably narrower and contracts forward, is made up of at least nine plates; there is a central scute, elongate, narrow and coffin-shaped, a difference from *Propalæohoplophorus*, in which there are two such plates, but each is asymmetrical by itself; on each side of this central scute is a longitudinal row of three much smaller scutes, while two small ones complete the shield in front. In addition to the twenty-two plates described, is a line of four very small plates over each orbit, the smallest of the cephalic scutes.

The ornamentation of the cephalic plates resembles that of the preceding genus with characteristic modifications. On the median posterior pair the grooves are shallow and the pattern is obscure, but there are two concentric rings of conspicuous piliferous pits; the other scutes, especially those of the anterior region, have much deeper grooves and the included figures are in correspondingly strong relief, which is far more marked than in the preceding genus, while the surface of the plates is much rougher and more coarsely punctate; the small supraorbital scutes have no definite pattern, merely a pitted surface.

As a whole, the cephalic shield extends from the occipital crest to some distance in front of the orbit, leaving the greater part of the rostrum exposed; laterally it roofs the temporal fossæ and the orbits, reducing the opening of the latter to a curiously small size.

In form and construction the carapace (Plates XIX, XX) resembles that of the preceding genus, and we find at least two movable bands on each side in the anterior region, each band being composed of seven plates. Behind these bands are seventeen transverse rows of plates, which are smaller and thicker near the lateral borders, becoming larger and thinner dorsally; they also increase in size posteriorly to the pelvic region, whence they again diminish toward the posterior border. The median dorsal area is thus a broad band of larger and thinner plates, which attain their greatest size in the pelvic region. The lateral margins of the carapace are slightly serrate and the posterior border strongly so.

The pattern of ornamentation is, over most of the carapace, essentially the same as in *Propalæohoplophorus*, but nearly all of the plates are rougher and more coarsely punctate than in the latter. The characteristic feature of *Cochlops*, which differentiates it clearly from all the other Santa Cruz glyptodonts, is a broad belt of scutes on each side of the carapace, beginning at the eleventh or twelfth transverse row and extending almost to the posterior border. This belt which is rather nearer to the median dorsal line than to the lateral border, is of somewhat irregular width, but generally includes five or six plates of each transverse row. Over most of the surface of the belt the only modification of the sculptural pattern consists in the presence of a very small, sharply pointed and conical tubercle, which is placed somewhat behind the middle of the large central figure of each plate. In the pelvic region, however, the pattern is greatly modified; the surface of the plates becomes very rough and in many of them has a wrinkled appearance, the ornamental pattern being nearly or quite obliterated, while in others the central figure is raised into a high, prominent and rugose cone, while the peripheral figures form a ring of lower conical tubercles around it. In each pelvic area there are two groups of plates with these conical elevations, but there is much individual variation in the development of the cones and in the number of plates upon which they are prominent. Always, however, there is one plate in the posterior group which most clearly and strongly displays these features. In this region of modified ornamentation two or more plates of the same transverse row may be coössified.

Lydekker has suggested ('94, 49) that these modified plates belong to aged individuals of *Propalæohoplophorus*, of which he regards *Cochlops* as a synonym. The much more abundant material contained in the recently made collections does not at all confirm this suggestion, but strengthens the opinion that the genera are distinct.

The tail-sheath (Plate XIX, fig. 2) resembles that of the preceding genus, but has certain characteristic modifications; it is made up of five anterior quite freely movable rings, and a posterior stiff, club-like mass, likewise composed of four rings of two rows of plates each; this portion is more tapering and less abruptly truncated than in the preceding genus, and its plates are thinner. The ornamentation of the anterior rings is nearly the same in the two genera, but in *Cochlops* the median ridge of the central figure ends in a somewhat more prominent posterior point.

The teeth display a difference from those of *Propalæohoplophorus*, which though slight, appears to be quite constant; in the last four upper teeth ($\underline{5-8}$) the division of the postero-external lobe by a vertical groove into two pillars is much more distinct. In both genera there is some variability in this respect and, with sufficiently numerous specimens, complete transitions between the two might perhaps be found, but, as a rule, it is not difficult to identify each genus by means of the teeth alone.

The skull of *Cochlops* (Plate XXVIII, figs. 1–4) differs hardly at all from that of the preceding genus and yields no diagnostic characters. The difference pointed out by Ameghino ('91, 326; '98, 310) that the fossa for the suborbital process of the zygoma, which in the preceding genus is present on the outer side of the horizontal ramus mandibuli, is lacking in *Cochlops*, I have not found to be entirely constant.

What little is known of the skeleton agrees closely with the corresponding parts of *Propalæohoplophorus*.

COCHLOPS MURICATUS Ameghino.

(Plates XIX, XX, XXIV, Figs. 12, 13; XXVIII, Figs. 1, 2.)

Cochlops muricatus Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent., 1889, p. 792.

Asterostemma granata Amegh., Ibid., p. 823.

Propalæohoplophorus granatus Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 39.

Propalæohoplophorus australis Lydekker, in part; Anales del Mus. de La Plata, T. III, 1894, p. 45.

This is the larger species of the genus and its carapace somewhat exceeds in size that of the average individual of *Propalæohoplophorus australis*, while the skull is relatively smaller. The carapace and tail-sheath are adequately known only in connection with this species and have already been described in the foregoing account of the genus; no important part of the cephalic shield has yet been obtained. The teeth differ from those of the smaller species, *C. debilis*, in being both actually and relatively broader, and the last upper tooth, $\underline{8}$, is considerably reduced in size.

In the following table of measurements, No. 1 is from a skull in the Ameghino collection, which is associated with large portions of the carapace, but, as the measurements were made from a photograph, they are probably a little too small. Nos. 15,191 and 15,331 are in the Princeton museum.

Measurements.

	No. 1.	*No. 15,191.*	*No. 15,331.*
Upper dentition, length	.096	.094	
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.004		
" width (*i. e.*, transverse diameter)	.0035		
$\underline{2}$, length	.007	.007	
" width	.005	.005	
$\underline{3}$, length	.010	.010	.010
" width	.005	.005	.005
$\underline{4}$, length	.011		.0115
" width	.007		.0065
$\underline{5}$, length	.013		.013
" width	.008		.007
$\underline{6}$, length	.014		.013
" width	.008		.0075
$\underline{7}$, length	.013	.012	.012
" width	.008	.008	.008
$\underline{8}$, length	.011	.0115	.0115
" width	.007	.007	.008

No complete skull of this species is known, all of the specimens being incomplete in one or other particular, and the different individuals do not supplement one another in a very satisfactory way. So far as it is preserved, this skull (Plate XXVIII, figs. 1, 2) differs but little from that of *Propalæohoplophorus australis;* the occiput is low, broad, erect and nearly plane, or slightly concave, with a more or less prominent vertical ridge for the vermis of the cerebellum; the occipital crest is of moderate prominence and thickness, except on the sides, where it is formed by the periotic and becomes heavy. The basioccipital is broad behind, narrowing anteriorly; its ventral surface is nearly flat, except posteriorly, where it is flared to form the margin of the foramen magnum; between the condyles it is incised by a deep, V-shaped notch. The sagittal crest is quite prominent, rather more so than in the preceding genus, and the zygomatic arch has a reëntering angulation on its ventral border, instead of forming one gentle, uninterrupted curve; in consequence of this, the orbit is rather more oblique; the lachrymal foramen is somewhat lower in position and nearer to the margin of the orbit; the incisive foramina are placed a little farther back and the posterior nares notch the palate more deeply.

MEASUREMENTS.

	No. 15,791.	*No. 15331.*
Cranium, length to rim of orbit	.116	.112
" width at postorbital constriction	.042	.043
" greatest width across zygomata	——	.120
Occiput, height	.033	——
" width at base	.066	.064
Zygomatic arch, breadth (vertical) behind postorbital process	——	.025
Rostrum, width at base	.050	.051
Palate, width at $\underline{1}$	.020	——
" " " $\underline{8}$	.025	.025

COCHLOPS DEBILIS Ameghino.

(Plate XXI, Fig. 5; XXIV, Fig. 15; XXVIII, Figs. 3, 4.)

Cochlops debilis Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 326.

The type of this species is the right mandibular ramus of a rather young individual. Ameghino's original diagnosis of it as follows: "Is distinguished by its smaller size and more slender form; the anterior part of the symphysis shows small alveoli for rudimentary incisors; length of the inferior dental series, 91 mm." (*loc. cit.*).

To this species I refer a skull, unfortunately lacking the mandible (Princeton collection, No. 15,592) which was found by Mr. Peterson at Corriken Aike. The almost complete cephalic shield which is attached to the skull makes it plain that this individual is not referable to *Propalæohoplophorus*, and the teeth display the characteristic features of *Cochlops* in a preëminent degree, while the relative narrowness of these teeth makes the reference to *C. debilis* altogether probable.

The cephalic shield (Plate XXI, fig. 5) has already been described in connection with the account of the genus and, as this structure is almost unknown in *C. muricatus*, its specific characteristics are not yet determinable.

The first upper tooth is so badly broken that no description can be given. The second is a little larger than in *C. muricatus* and has two rather more distinct vertical grooves on the inner side; $\underline{3}$ also is more distinctly lobate than in the preceding species, the single external and two internal grooves being decidedly deeper; $\underline{4}$ differs from that of *C. muricatus* merely in its relative narrowness, which is principally due to the lesser development of the antero-internal lobe; the grooves also are somewhat shallower. The remaining upper teeth ($\underline{5}$–$\underline{8}$) closely resemble those of the other species, especially in the conspicuous subdivision of the postero-external lobe, the chief difference being in the somewhat smaller size and proportionate narrowness of these teeth in the present species. Another important difference is in the great vertical height of the teeth in *C. debilis.*

MEASUREMENTS.

Upper dentition, length	?.092	$\underline{5}$, length	.013
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	?.006	" width	.006
$\underline{2}$, length	.0075	$\underline{6}$, length	.0125
" width (*i. e.*, transverse diameter)	.0045	" width	.007
$\underline{3}$, length	.010	$\underline{7}$, length	.012
" width	.0045	" width	.007
$\underline{4}$, length	.012	$\underline{8}$, length	.0115
" width	.0055	" width	.007

The skull (Plate XXVIII, figs. 3, 4), while very like that of *C. muricatus* in its general appearance and proportions, yet differs from it in a number of not unimportant particulars. The occiput is notably higher and narrower, in which respect it differs decidedly from that of any other known Santa Cruz glyptodont; the occipital surface is quite deeply concave and has no median prominence for the vermis of the cerebellum. This concavity is largely due to the development of the occipital crest, which is not only prominent, but unusually thick and massive, especially on the sides. The occiput also has a slight forward inclination, which, however, is not so distinct as in *Metopotoxus*, and in side-view is somewhat concealed by the prominent crest. When the plane of the teeth is held horizontally, the basicranial axis has a slight inclination downward and forward. The periotic is quite largely exposed upon the surface of the cranium and ends ventrally in a very blunt and heavy mastoid process.

The zygomatic arch has, in an exaggerated degree, the peculiarities seen in *C. muricatus;* the posterior portion is horizontal, while the anterior descends more steeply, making the angulation of the ventral border more distinct and giving a more oblique position to the orbit; the glenoid cavity is raised higher above the level of the teeth than in any other known Santa Cruz glyptodont. The preorbital fossa in the maxillary is much better defined than in *C. muricatus*, but is hardly visible when the skull is viewed from above. The alveolar portion of the maxillary has a greater vertical extension than in any other contemporary glyptodont, and to this is due the greater elevation of the glenoid cavity and the steeper inclination of the zygomatic arch. The forehead and muzzle are more convex on the dorsal side than those of *Propalæohoplophorus australis.*

MEASUREMENTS.

Cranium, length to rim of orbit	.112
" width over zygomata	.105
Occiput, height	.046
" width at base	.057
Basioccipital, width posteriorly	.030
" " anteriorly	.016
Glenoid cavity, elevation above $\underline{8}$	.045
Zygoma, length	.083
" width behind postorbital process	.025
Distance occipital condyle to glenoid cavity	.045
Rostrum, width at base	.041
Palate, width at $\underline{8}$	.025

EUCINEPELTUS Ameghino.

(Plates XXI, Figs. 2–4; XXIV, Figs. 9–11; XXVI, Fig. 9; XXIX, Figs. 1–5.)

Eucinepeltus Amegh., Rev. Argent. de Hist. Nat., T. I, 1891, p. 326.

Propalæohoplophorus Mercerat, in part; Rev. del Mus. de La Plata, T. II, 1891, p. 28.

Propalæohoplophorus Lydekker, in part; Anales del Mus. de La Plata, T. III, 1894, p. 45.

A very distinct genus, which includes the largest glyptodonts yet discovered in the Santa Cruz beds and may be readily recognized by the peculiarities of the cephalic shield. Except for its larger size, the carapace is not distinguished by any important characters of form, composition, or ornamentation from that of *Propalæohoplophorus*, save that all the plates have a smooth, flat surface, and in none of them is the central figure raised into a low convexity, as it is in the hinder part of the carapace of the last named genus. Another slight difference appears to be that in *Eucinepeltus* the lateral marginal plates are of more uniform width, making the lateral borders smooth and non-serrate.

On the other hand, the cephalic shield (Plate XXI, figs. 2–4) is altogether different from that of any other contemporary genus; it is a single thick and massive bone, convex dorsally and concave ventrally and made up by the fusion of the plates, which vary in number from eleven to fifteen, according to the species. The approximate edges of a number of these plates, also varying according to the species, are raised into very prominent, jagged ridges, with a line of conspicuous piliferous pits on each side of the ridge. The surface of the plates is nearly smooth, finely granular, or punctate, without any definite ornamental pattern, though having a convexity in the centre, which, in a variable number of the plates is marked by a large, deep pit, with raised edges and very rough sides; sometimes there is a small cone at the bottom of the pit, as if for the attachment of a spine or horn. The number of scutes thus marked differs in each species, though perhaps not constantly, but the pits are always present on the two median posterior pairs of plates. In *E. petestatus* the anterior pair of plates have median bosses, all the others are pitted; in *E. complicatus* all the scutes have pits, and in *E. crassus* only the two median posterior pairs are so marked, though very small, shallow pits are present in irregular fashion on the others, suggesting that, to a certain extent, the pits were obliterated with advancing age.

The teeth (Plate XXIV, figs. 9–11) differ quite strikingly in the different species, though nothing is yet known of *E. crassus* in this respect. In *E. petestatus* the anterior teeth are remarkably simple and the first upper three are elliptical, while in *E. complicatus* there is little difference between these teeth and the corresponding ones of *Propalæohoplophorus.* Both species, however, agree and differ from the last-named genus in the very slight indication of a subdivision of the postero-external lobe on the posterior upper teeth ($^{4-8}$).

The skull (Plate XXIX) is very different in its proportions from that of *Propalæohoplophorus.* The cranium is much depressed and very broad, as is particularly well shown in the view of the occiput (fig. 4); the forehead is flattened and very wide, extending much more over the orbits than in the last-named genus and ending in much more distinct postorbital processes; the rostrum is relatively longer and more tapering, but remains broader and more depressed throughout; the zygomatic arch extends out more widely from the side of the cranium and is broader dorso-ventrally; the jugal has a much more prominent postorbital process, while the descending suborbital process is relatively shorter; the lachrymal foramen is smaller and nearer to the edge of the orbit, the anterior rim of which is much more distinctly elevated and flared.

The mandible, which is known only in *E. petestatus*, differs notably from that of *Propalæohoplophorus;* the symphysis is longer and narrower and the edentulous part of the alveolar border is not everted to such an extent; the horizontal ramus is relatively shorter and deeper and its ventral border is more regularly curved; the mental foramen is very small, and on the ascending ramus is a deep fossa, which Ameghino regards as a remnant of the alveolar canal ('98, 210).

Very little is known of the skeleton, but the parts which have been found differ little, save in size, from those of the other contemporary glyptodonts. In the collection of the American Museum is a nearly complete "dorsal tube," which from its size is probably referable to this genus. Like that of *Propalæohoplophorus,* this tube is composed of seven vertebræ, doubtless the last six thoracics and the first lumbar, and it displays a number of interesting differences from the last-named genus. As a whole, the tube has a stronger curvature and the bony ridge which connects the successive transverse processes is considerably heavier; the first vertebra of the mass (? sixth thoracic) is more completely fused with the succeeding one, and is somewhat shorter; at the anterior end the neural canal is small and almost circular, but changes its shape posteriorly, becoming larger and of a vertically oval cross-section.

Three species of this genus may be distinguished, *E. petestatus* Ameghino, *E. complicatus* Brown, and *E. crassus*, sp. nov.

EUCINEPELTUS PETESTATUS Ameghino.

(Plate XXI, Fig. 4; XXIV, Figs. 10, 11.)

Eucinepeltus petestatus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 326.

Propalæohoplophorus patagonicus Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 40.

Propalæohoplophorus australis Lydekker, in part; Anales del Mus. de La Plata, T. III, 1894, p. 48.

Ameghino has described the cephalic shield (Plate XXI, fig. 4) of this species as consisting of nine plates, two in the anterior row, three in the middle, and four in the hinder row. It is, however, almost certain that the two very large posterior median plates are themselves compound and that the actual number is eleven, arranged in four transverse rows, which, beginning anteriorly, have the following number of plates: two, three, four, two. The sutures are raised into ridges of only moderate height and all the plates have the median pit, except the anterior pair, in which the pit is replaced by a low elevation. As a whole, the shield is of irregularly circular shape, narrowing forward, and there is no marked constriction of the borders between the first and second rows of plates.

The carapace is known only in connection with this species and the account of it, already given, need not be repeated here.

The teeth (Plate XXIV, figs. 10, 11) are remarkable for the simplicity of those in the anterior part of the mouth. In the upper jaw, $^{\underline{1}}$, $^{\underline{2}}$, and $^{\underline{3}}$ are of longitudinally elliptical form and have no complications of any kind, the others are all relatively broad; on the last four teeth, $^{\underline{5-8}}$, the division of the postero-external lobe is very feebly, or not at all indicated, while the division of the anterior prism into internal and external lobes is very distinct. In the mandible, $_{\overline{1}}$, $_{\overline{2}}$, and $_{\overline{3}}$ have successively larger grinding surfaces, of reniform shape with the concavity turned outward; $_{\overline{4}}$ is of similar general form, but obscurely trilobate, while $_{\overline{5-8}}$ are typically so.

The skull is very large, but those of the Ameghino collection were, at the time of my visit, so concealed in the matrix that no description of them can be given, other than to note the relatively great length of the rostrum. Ameghino in his original description gives the length of the skull as 180 mm.

The following measurements are approximate only, as they are taken from photographs of the type specimen in the Ameghino collection.

MEASUREMENTS.

Cephalic shield, length	.135
" " width	.138
Upper dentition, length	.110
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.006
" width (*i. e.*, transverse diameter)	.0045
$^{\underline{2}}$, length	.007
" width	.006
$^{\underline{3}}$, length	.009
" width	.006
$^{\underline{4}}$, length	.011
" width	.009
$^{\underline{5}}$, length	.013
" width	.009
$^{\underline{6}}$, length	.015
" width	.009
$^{\underline{7}}$, length	.014
" width	.010
$^{\underline{8}}$, length	.015
$^{\underline{8}}$, width	.0095
Lower dentition, length	.113
$_{\overline{1}}$, length	.0065
" width	.0035
$_{\overline{2}}$, length	.007
" width	.005
$_{\overline{3}}$, length	.011
" width	.007
$_{\overline{4}}$, length	.014
" width	.007
$_{\overline{5}}$, length	.015
" width	.0055
$_{\overline{6}}$, length	.0145
" width	.007
$_{\overline{7}}$, length	.014
" width	.0065
$_{\overline{8}}$, length	.016
" width	.0065

EUCINEPELTUS COMPLICATUS Brown.

(Plates XXI, Fig. 3; XXIV, Fig. 9; XXIX, Figs. 1–5.)

Eucinepeltus complicatus Brown; Bull. Am. Mus. Nat. Hist., Vol. XIX, 1903, p. 453.

This species is very distinct from the preceding one, from which it differs notably in the conformation of the cephalic shield and in the pattern of the teeth. The shield (Plate XXI, fig. 3) is somewhat smaller than in *E. petestatus* and it is of quite a different form, the lateral borders being more constricted, or notched, at the junction of the first and second rows of plates. The first pair of plates are smaller, as is also the median unpaired plate of the entire structure, the middle scute of the second row; on the other hand, the two posterior pairs of median plates are relatively larger. The sutural borders are raised into very prominent and jagged ridges, which are much more conspicuous than in either of the other species, and each of the plates has a central pit, which is especially striking in the median pair of the third row; here the pit has an irregularly circular shape, with raised margin and very rough sides, and at the bottom a small cone, the whole resembling a minute model of a volcanic crater-ring enclosing a cone of eruption.

The teeth (Plate XXIV, Fig. 9) resemble those of *Propalæohoplophorus* rather than those of *E. petestatus*, especially in the anterior region. In the upper jaw $^{\underline{1}}$ is rather large with elliptical grinding surface and is set obliquely to the line of the other teeth so as to approach its fellow of the opposite side; $^{\underline{2}}$ is larger, less oblique and made obscurely trilobate by two vertical grooves on the inner face and a somewhat less distinct groove on the outer; $^{\underline{3}}$ is still larger and more distinctly trilobate on the inner side. The remaining teeth do not differ in any important way from those of *E. petestatus*, but have a rather more slender and delicate appearance.

It is not yet practicable to make a comparison of the skull (Plate XXIX, figs. 1–5) with that of the preceding species, but one difference is sufficiently obvious, namely, that in *E. complicatus* the rostrum is relatively less elongate and much broader at the base. On each side of the hard palate, opposite the hinder end of $^{\underline{4}}$, is a large foramen, from which a groove runs forward nearly to the premaxillary border; in addition, the palate is perforated by the usual number of vascular foramina. The posterior narial canal has a large dorso-ventral diameter.

The following measurements are from the type specimen (A. M. N. H., No. 9248), which was collected by Mr. Brown.

MEASUREMENTS.

Cephalic shield, length	.130
" " width	.133
Upper dentition, length	.109
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.008
" width (*i. e.*, transverse diameter)	.004
$\underline{2}$, length	.009
" width	.0055
$\underline{3}$, length	.012
" width	.007
$\underline{4}$, length	.0125
" width	.008
$\underline{5}$, length	.0145
" width	.008
$\underline{6}$, length	.015
" width	.0085
$\underline{7}$, length	.014
" width	.0085
$\underline{8}$, length	.0135
" width	.008
Skull, length in median basal line	.156

Skull, extreme length	.175
Cranium, length to rim of orbit	.125
Face, length	.053
Cranium, width over zygomata	.135
" " at postorbital constriction	.049
Forehead, width at postorbital processes	.090
Occiput, height	.043
" width at base	.087
Zygomatic arch, extreme length	.098
" " greatest dorso-ventral width	.028
Zygomatic arch, length of suborbital process	.045
" " distance between suborbital processes	.111
Rostrum, length	.043
" width at base	.063
" " " anterior end	.041
Palate, length in median line	.117
" width at $\underline{1}$	.014
" " " $\underline{8}$	.025

EUCINEPELTUS CRASSUS sp. nov.

(Plates XXI, Fig. 2, XXVI, Fig. 9.)

The type and only known specimen (Princeton Mus. No. 15,865) is unfortunately very incomplete; it consists of the cephalic shield, a few plates of the carapace, an ungual phalanx of the manus and several bones of the pes. The characters of the species are given by the cephalic shield (Plate XXI, fig. 2), which differs from that of the other two species in shape and in the number of plates which compose it. This number is fifteen, instead of eleven, and the transverse rows have the following number of plates, counting from before backward; two, two, five, four, two. The foremost pair of plates are very small and somewhat asymmetrical, that on the right side being distinctly the larger of the two. These scutes appear not to be represented at all in the other species, in the type-specimens of which the shields were found in place and with anterior margins entire, not indicating that the plates in question had been broken away. The other additional plates are found in the third row, which thus numbers five, instead of three as in the other species; these additional plates are of triangular shape and extend the lateral, wing-like processes of the shield, giving them a greater antero-posterior extension than in the other species. The scutes of the second row, which corresponds to the first row of the two preceding species, are relatively larger than in either of the latter and the shield, as a whole, is of a different shape, as it narrows forward much more rapidly from the lateral wings. The sutural lines are less elevated than in *E. complicatus* and are conspicuous only around the large group formed by the two posterior pairs of median plates. These same four plates are the only ones on which the central pits are well displayed; on the others, the pits are either very small, or entirely wanting. Whether this is due to the age of the individual, or is characteristic of the species, cannot, of course, be determined from a single specimen.

The few foot-bones that have been preserved differ but little, except in size, from the corresponding parts of *Propalæohoplophorus*. An ungual phalanx of the manus is long, decurved and bluntly pointed. The cuboid is relatively longer proximo-distally and narrower than in the last named genus and the process from the plantar side is remarkably prominent and massive. The third and fourth metatarsals (Plate XXVI, fig. 9) are proportionately somewhat narrower and more elongate than in the other genus, and have longer shafts, with greater relative distance between the proximal and distal thickenings; the distal trochlea of metatarsal IV has its dorsal portion divided into two distinct facets by a broad, shallow sulcus. The phalanges also are similar to those of *Propalæohoplophorus*, but the ungual of digit II, the only one preserved, is rather more elongate and depressed.

In the following table are included measurements of a calcaneum and astragalus, which though found separately, agree so well in their proportions with the other bones of the pes that they may belong to the present species; at all events they may be confidently referred to *Eucinepeltus*.

The type of the species was collected by Mr. Hatcher at Killik Aike, on the Gallegos river.

MEASUREMENTS.

Cephalic shield, length	.148
" " width	.136
Pisiform, length	.033
" width of proximal end	.010
Ungual, digit I, manus, length	.032
Ungual, digit I, manus, width of proximal end	.0155
Ungual, digit I, manus, thickness of proximal end	.0185
Calcaneum, length	.063
" " of tuber	.034
" width of proximal end	.022
" " " distal end	.019
" " across sustentaculum	.030

Astragalus, length	.0315
" width of trochlea	.030
" " " head	.020
" thickness of head	.0185
Cuboid, length	.020
" width	.019
" thickness	.028
Metatarsal III, length	.037
" " width of proximal end	.019
Metatarsal III, width of distal end	.016
" " " " shaft	.0125
Metatarsal IV, length	.031
" " width of proximal end	.014
" " " " distal end	.014
" " " " shaft	.013
First phalanx, digit II, length	.012
First phalanx, digit II, width of proximal end	.018
" " " " width of distal end	.014
Second phalanx, digit II, length	.010
" " " " width of proximal end	.016
" " " " width of distal end	.016
" " digit III, length	.013
" " " " width of proximal end	.017
" " " " width of distal end	.016
Ungual, digit II, length	.023
" " " width of proximal end	.024

ASTEROSTEMMA Ameghino.

(Plates XXI, Fig. 6; XXIV, Fig. 7.)

Asterostemma Amegh.; Contr. al Conoc. de los Mam. Fos. de la Repúb. Argent., 1889, p. 822.

Propalæohoplophorus Mercerat, in part; Rev. del Mus. de La Plata, T. II, 1891, p. 28.

Propalæohoplophorus Lydekker, in part; Anales del Mus. de La Plata; T. III, 1894, p. 45.

The status of this genus is somewhat uncertain and more complete material is greatly to be desired, but, pending the discovery of this material, it seems better to keep the genus distinct, for there is much reason to believe that it really is so.

The plates of the carapace have an ornamentation similar to that of *Propalæohaplophorus*, but, so far as they are known, they always have the central figure flat, or even slightly concave, never raised or convex. To this genus I refer a remarkable isolated tail-sheath (Plate XXI, fig. 6) collected by Mr. Hatcher in the Santa Cruz beds on Lake Pueyrredon; this sheath is quite markedly different from that of any other known glyptodont. The anterior part of the sheath is made up of movable rings, each with two rows of plates, but in the posterior part the plates are slightly imbricating and while arranged in more or less regular rings, each ring is composed of only one row of plates, the appearance being more armadillo-like than glyptodont. Another and even more obvious difference from the preceding genera is in the shape of the tail as a whole, which is very slender in the hinder portion and tapers gradually to a point, instead of being thick, club-like and truncated at the end. This specimen cannot be referred to any of the preceding genera and it is assigned to *Asterostemma*, because in the Ameghino collection is a fragment of a similar tail-sheath, which was found associated with carapace-plates of the type originally referred to this genus.

In the same collection is the facial portion of a skull, also associated with similar plates, which displays a number of significant peculiarities. One of these peculiarities is in the form of the upper teeth (Plate XXIV, fig. 7) of which only $^{\underline{5}}$ has a trace of the division of the postero-external lobe into two pillars, while on the succeeding teeth ($^{\underline{6}}$–$^{\underline{8}}$) there is no sign of such a division. *Asterostemma* is the only known Santa Cruz glyptodont of which this is true and the significance of the fact lies in the resemblance of these teeth to those of the later representatives of the order, in which the division does not occur, save in $^{\underline{8}}$ of *Sclerocalyptus*.

Concerning the skull, Ameghino remarks that "the premaxillaries are rudimentary, not reaching the nasals" ('98, 210). With this description I am not able entirely to agree. I think Dr. Ameghino has been deceived by the fact that the premaxillaries have been lost from the specimen in question, leaving a smooth edge of the maxillaries, which thus appears to form the true boundary of the anterior nares. On the other hand, a nasal process of the maxillaries seems to have prevented any contact between the premaxillæ and the nasals. The palatine processes of the maxillæ are deeply notched by the incisive foramina, which extend as far back as the middle of $^{\underline{2}}$, and are thus very much larger than in any of the preceding genera. The nasals are longer, narrower, more pointed anteriorly, and extend farther in advance of the maxillaries than in *Propalæohoplophorus*. Altogether, this region of the skull is quite characteristically different from the muzzle in the other contemporary genera.

While most of the Santa Cruz glyptodonts appear to be without phylogenetic importance and probably were not directly ancestral to any of the later types, *Asterostemma* may prove to be the common ancestor of many of the Pampean genera. The tail-sheath is the least specialized yet discovered in the order and the character of the teeth is very suggestive, but the materials are still insufficient to justify a more positive statement.

ASTEROSTEMMA DEPRESSA Ameghino.

(Plates XXI, Fig. 6; XXIV, Fig. 7.)

Asterostemma depressa Amegh.; Contrib. al Conoc. de les Mam. Fos. de la Repúb. Argent., 1889, p. 823.

Propalæohoplophorus australis Mercerat, in part; Rev. del Mus. de La Plata, T. II, 1891, p. 35.

Propalæohoplophorus australis Lydekker, in part; Anales del Mus. de La Plata, T. III, 1894, p. 48.

Of the three species originally assigned to this genus, only the present one remains, one of the others, *A. granata*, proving to be synonymous with *Cochlops muricatus*, while the third has become the type of *Metopotoxus lævatus.* The following measurements are taken from a photograph of the skull in the Ameghino collection above described.

MEASUREMENTS.

Upper dentition, length	.101
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.004
" width (*i. e.*, transverse diameter)	.007
$\underline{2}$, length	.0075
" width	.005
$\underline{3}$, length	.011
" width	.005
$\underline{4}$, length	.012
" width	.006
$\underline{5}$, length	.014
$\underline{5}$, width	.0065
$\underline{6}$, length	.014
" width	.0075
$\underline{7}$, length	.013
" width	.007
$\underline{8}$, length	.0125
" width	.007
Palate, length	? .102
" width at $\underline{1}$	.014
" " " $\underline{8}$	.028

? *DŒDICURIDÆ.*

METOPOTOXUS Ameghino.

(Plates XXIV, Ffg. 8; XXVIII, Fig. 5; XXIX, Fig. 6.)

Asterostemma Amegh., in part; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent., 1889, p. 822.

Metopotoxus Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 210.

Though still very imperfectly known, this genus is sufficiently well distinguished. The plates of the carapace, so far as they have been recovered, have an ornamentation like that of *Propalæohoplophorus*, but with flat or slightly concave central figure and unusually conspicuous piliferous pits. The few isolated scutes of the cephalic shield that have been found indicate that this structure was probably quite different from the head-shield of the other genera: the plates are separate and display hardly any remnant of an ornamental pattern, but have a punctate surface, some finely and others coarsely granular; the large postero-median plates resemble those of *Cochlops* in having two concentric rings of conspicuous pits, but the surface is more rugose.

The teeth are, in general, like those of *Propalæohoplophorus*, except that in the posterior region of the upper jaw (${}^{\underline{5-8}}$) they have the postero-external lobe much more deeply divided, making four outer lobes.

The special peculiarity of the genus is in the form of the rostrum, which is very short, with its dorsal surface sloping very steeply downward, suggestively like the rostrum of *Panochthus*. This character is particularly well shown in the type-species, *M. lævatus*, while in the presumably older *M. anceps* it has not been carried so far.

It is not at all improbable that in this genus we have the ancestor of *Panochthus*, but this conclusion must remain merely tentative until much more complete material has been obtained.

METOPOTOXUS LÆVATUS Ameghino.

Asterostemma lævata Amegh.; Contrib. al Conoc. de les Mam. Fos. de la Repúb. Argent., 1889, p. 823.

Propalæohoplophorus lævatus Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 38.

Propalæohoplophorus australis Lydekker, in part; Anales del Mus. de La Plata, T. III, 1894, p. 48.

Aside from plates of the carapace and head-shield, the only known examples of this species are two fragments of skulls in the Ameghino collection, each containing most of the upper teeth of the right side. The anterior teeth, ${}^{\underline{1}}$ and ${}^{\underline{2}}$, are relatively larger than in the preceding genera; ${}^{\underline{4}}$ has a very small median external pillar, while in the preceding genera this tooth has a broad median valley on the outer side; it also has a subdivided postero-external lobe. This division of the postero-external lobe is repeated on all the succeeding teeth (${}^{\underline{5-8}}$) to a degree even more marked than in *Cochlops*. The rostrum is extremely short and the forehead strongly convex, with upper contour sloping downward very steeply. The lachrymal foramen has a very elevated position.

The measurements are from a photograph of one of the Ameghino specimens.

MEASUREMENTS.

Upper dentition, length $\underline{1}$ to $\underline{5}$ inclusive.	.057	$\underline{3}$, length	.011
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.004	" width	.0055
$\underline{1}$, width (*i. e.*, transverse diameter)	.006	$\underline{4}$, length	.012
$\underline{2}$, length	.009	" width	.0065
" width	.006	$\underline{5}$, length	.014
		" width	.008

METOPOTOXUS ANCEPS sp. nov.

(Plates XXIV, Fig. 8; XXVIII, Figs. 5, 6; XXIX, Fig. 6.)

This is a smaller and less modified species than *M. lævatus* and is probably a little earlier in geological date. The type specimen (Princeton Mus., No. 15,612) which was collected by Mr. Peterson at Lake Pueyrredon, is a skull, without mandible, which, though somewhat damaged at the anterior end and with most of the teeth broken, is yet in an excellent state of preservation and quite free from distortion.

The upper teeth (Plate XXIV, fig. 8) differ in a number of details from those of the preceding species; $\underline{1}$ and $\underline{2}$ are actually and relatively smaller; $\underline{3}$ is elongate and very simple, the trilobation on the inner side being very feebly marked, while in *M. lævatus* it is distinct; $\underline{4}$ is missing and of $\underline{5}$ only the posterior half remains, which shows that the median external lobe is much less developed than in the other species and the division of the postero-external lobe less distinct; on $\underline{6}$ and $\underline{7}$, however, this division is quite as marked, but on $\underline{8}$ it again becomes faint.

The skull (Plates XXVIII, figs. 5, 6; XXIX, fig. 6) is quite notably different from that of any other Santa Cruz glyptodont. The occiput is relatively higher and narrower than in the other species, except *Cochlops debilis*, and has a decided forward inclination, while in all the other contemporary species (*M. lævatus* doubtless excepted) the plane of the occiput is nearly vertical; the occipital crest is neither very thick nor very prominent, while the sagittal crest is very feebly marked and is, in fact, rather an area than a crest. The basioccipital is very broad posteriorly, much wider proportionately than in any of the preceding genera; it rapidly narrows toward the anterior end, where it suddenly increases in dorso-ventral thickness; its ventral surface is without a keel, but has a shallow median depression in the posterior part. A very marked difference from all the preceding genera is the absence of the deep V-shaped notch in the posterior border of the basioccipital, which, in the present species, is represented merely by a broad and very shallow emargination. The condyles, which are small and of the usual semicylindrical form, are very widely separated, in correlation with the unusual breadth of the basioccipital. The basisphenoid is considerably broader than the latter at their common suture and thus the fossæ in the cranial floor are very much wider than usual. How far these great open spaces were filled by the missing tympanics, it is impossible to say, but their shape, as determined by the difference in breadth between the basioccipital and basisphenoid is different from that of any other Santa Cruz glyptodont.

The cranium is rather narrow, contracting forward gradually to the postorbital constriction, and then gently expanding to the forehead. The upper profile of the skull, when seen in side-view, is gently convex from the occipital crest to the coronal suture, and somewhat more strongly convex from that suture to the end of the rostrum; the forehead is much inflated by the large frontal sinuses and the profile of the rostrum, while less steeply inclined than in *M. lævatus*, is more so than in any of the preceding genera. The parietals are large, forming most of the roof and sides of the cerebral fossa; they are perforated by several vascular foramina, which, however, are neither so large nor so numerous as in the other genera, nor is the surface of the bones so rugose, but, on the contrary, quite smooth and dense.

The zygomatic arch is of about the same relative length as in *Propalæohoplophorus*, but is less expanded, while the descending suborbital process is rather longer, more slender and more pointed at the distal end.

The frontals are very large proportionately; their postorbital processes are very feebly indicated, while those of the jugals are quite distinct. The maxillaries have extremely short preorbital portions, but the palatine processes are of the usual form. The pterygoids are narrower and less rugose than those of *Propalæohoplophorus*.

Attached to the skull are the first four cervical vertebræ. The atlas resembles that of the last-named genus, being very broad and short; the inferior arch is slender and rod-like, and the neural arch is much more extended antero-posteriorly; there is no spine, that of the axis reaching over nearly the entire width of the neural arch; the foramina and transverse processes are of the usual type. The compound vertebra which succeeds the atlas is made up of the axis fused with the third and fourth cervicals, thus consisting of three vertebræ, instead of four as in *Propalæohoplophorus*. As the individual is fully adult, this difference cannot be attributed to age and is not without importance.

MEASUREMENTS.

Upper dentition, length	.093
“ “ “ $\underline{1}$ to $\underline{5}$ inclusive	.050
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.004
$\underline{2}$, length	.006
$\underline{3}$, “	.011
“ width (*i. e.*, transverse diameter)	.004
$\underline{6}$, length	.0125
“ width	.006
$\underline{7}$, length	.0115
“ width	.007
$\underline{8}$, length	.012
“ width	.007
Skull, extreme length	? .140
Cranium, length to rim of orbit	.106
“ width at postorbital constriction	.036
“ “ over zygomatic arches	.097
“ “ “ postorbital processes	.052
Occiput, height	.041
“ breadth	.053
“ distance between condyles	.027
Basioccipital, posterior width	.027
Basioccipital, anterior width	.012
Zygoma, length	.069
“ dorso-ventral width	.022
“ length suborbital process	.048
“ width over suborbital processes	.090
“ “ of suborbital process at distal end	.010
Face, length	? .040
Rostrum, length	? .027
“ width at base	.045
Palate, width at $\underline{1}$	.015
“ “ “ $\underline{8}$	.023
Atlas, length	.017
“ width over anterior cotyles	.045
“ “ of neural arch	.012
“ “ “ inferior arch	.008
Axis, length of centrum	.011
“ width of anterior face	.042
Third cervical, length	.006
Fourth “ “	.010
“ “ width of posterior face	.035
Compound cervical, length	.027

As a more convenient method of comparing the skull of this species with that of *Propalæohoplophorus australis* and clearly displaying their differences of proportions, the following table of relative measurements has been prepared. The distance from the anterior border of the occipital condyle to that of the first upper tooth is taken as 100 and the other measurements are calculated in percentages of that distance; the calculation is not carried beyond the first decimal place.

	P. australis.	*M. anceps.*
Distance anterior border of occipital condyle to $\underline{1}$	100	100
Cranium, length to anterior rim of orbit	77.5	83.4
“ width at postorbital constriction	27.5	25.3

	P. australis.	*M. anceps.*
Cranium, width at postorbital processes	36.9	40.9
" " over zygomatic arches	80.4	76.3
Occiput, height	28.9	32.2
" width	47.1	40.9
" distance between condyles	18.8	21.2
Zygomatic arch, length	57.9	54.3
" " " of suborbital process	33.3	37.7
" " width across descending processes	72.4	70.8
Rostrum, length	28.9	? 21.2
" width at base	34.7	35.4

GRAVIGRADA.

Among the edentates of the Santa Cruz formation the Gravigrada are incomparably the most numerous in individuals, as well as in species and genera, forming indeed one of the most conspicuous and characteristic elements of the fauna. In marked contrast to what we have learned regarding the armadillos and glyptodonts of the epoch, the Santa Cruz ground-sloths appear to have great phylogenetic significance; and forerunners, if not the actual ancestors of almost all the great Pleistocene genera of North and South America, may be observed in this fauna. Whether these Santa Cruz types are or are not the ancestors sought for, cannot be satisfactorily determined until more has been learned concerning the faunas intermediate in time between the Santa Cruz and the Pampean, for phylogenetic problems can be solved only by tracing the successive steps of descent. For all practical purposes, however, we may regard these Santa Cruz genera as the actual ancestors, for they must at least represent those ancestors in all the essentials of structure.

Three families of the Gravigrada are represented in the Santa Cruz fauna, but in very unequal proportions. By far the greater number of individuals, of species and of genera are members of the *Megalonychidæ;* the *Planopsidæ* are much less common, and the *Mylodontidæ* are very rare. In consequence of this disproportion in the representation of the three families, our knowledge of the structural characteristics of each is very unequal. Several genera of the *Megalonychidæ* are very completely known; concerning only one genus of the *Planopsidæ* have we any considerable information, while, except for the teeth and skull, the *Mylodontidæ* are almost unknown. Consequently, any general statements regarding the Santa Cruz Gravigrada, as a group, can be made only with reservations, since full information is available with reference to but one of the three families.

Ameghino has already given a summary of the more important structural features of the Santa Cruz Gravigrada ('94*a*, 141), but much additional material has been gathered since that account was written and this material permits a somewhat more extended description. In what follows, however, there is necessarily much repetition of Ameghino's generalizations.

(1) Like the other Santa Cruz edentates, the Gravigrada are far smaller in stature than their Pleistocene successors; many of them are exceedingly small and only one or two are large enough to rival the lesser Pleistocene genera, such as *Nothrotherium* (*Cœlodon*) and *Scelidotherium*.

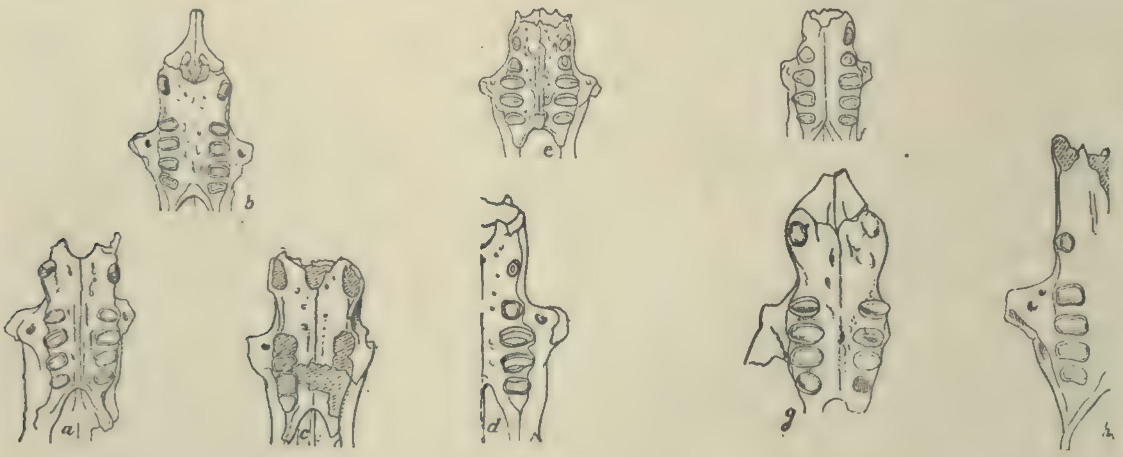

Fig. 14.

Upper teeth of Santa Cruz Gravigrada, × $\frac{1}{8}$. *a*, *Hapalops indifferens*; *b*, *H. elongatus*; *c*, *Megalonychotherium atavus*; *d*, *Analcimorphus giganteus*; *e*, *Schismotherium splendens*; *f*, *Pelecyodon cristatus*; *g*, *Hyperleptus garzonianus*; *h*, *Planops magnus*.

(2) No trace of dermal ossifications has been found in connection with any of the skeletons. At first sight, this may seem surprising, but it should be remembered that an exoskeleton could be expected to occur only in the *Mylodontidæ* and that the material representing this family in the Santa Cruz beds is so rare and so imperfect that the negative evidence is without weight.

(3) With the possible exception of *Trematherium* and certain very doubtful forms, the dental formula is invariably $\frac{5}{4}$; the teeth may be in

continuous series, but more commonly the first tooth in each jaw is separated by a diastema from the succeeding ones and is more or less caniniform; almost always this tooth differs from the others in shape, being usually cylindrical, or obscurely trihedral, and quite small. Sometimes, however, as in *Eucholœops*, it is a formidable weapon, like the tusk of the Pampean *Lestodon*, and in *Megalonychotherium* it is much enlarged and laterally compressed. One specimen has been found in which ^{1} is transversely grooved by attrition, but this is probably abnormal, as the tooth is otherwise of the usual shape. The first upper tooth is always confined to the maxillary and may be inserted near the anterior border of that bone, or far behind it. When the jaws are closed, $_{1}$ always passes behind ^{1}, showing that the former at least cannot be a true canine. Except in the *Mylodontidæ*, the grinding, or molariform, teeth are of transversely oval, rectangular, or subtrihedral form, with two cross-crests and deep intervening valley produced by the abrasion of the opposing teeth, and of course absent in very young stages. In the *Mylodontidæ* several of the teeth have already become angular and lobate, but with an extraordinary variability of form. As in the Pampean genera, the teeth have an

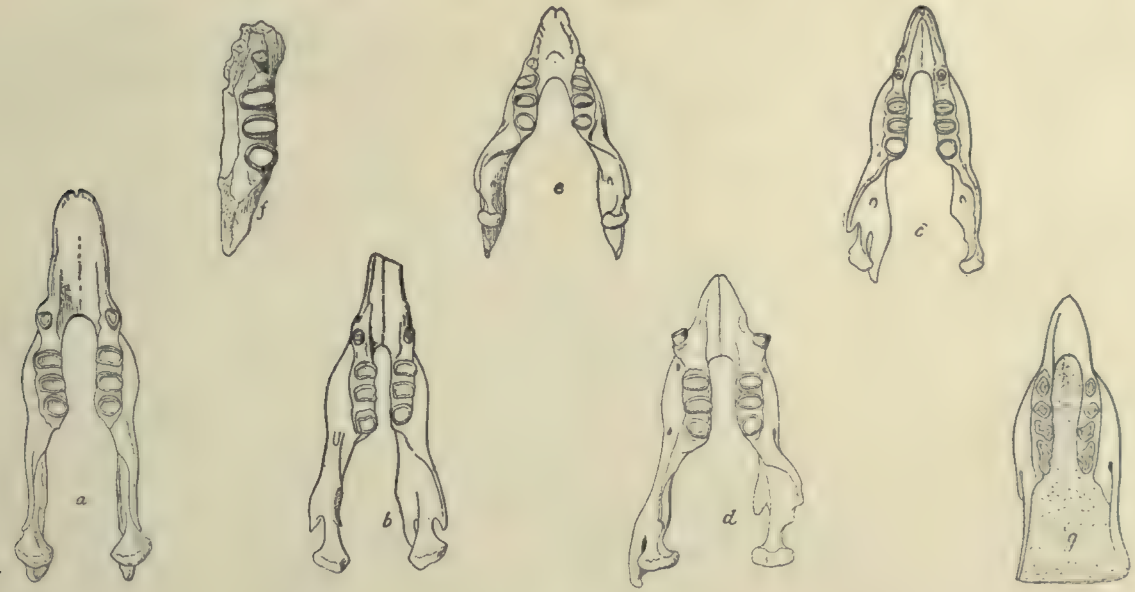

FIG. 15.

Lower teeth of Santa Cruz Gravigrada, × $\frac{1}{8}$. *a*, *Hapalops longiceps*; *b*, *H. indifferens*; *c*, *H. elongatus*; *d*, *Eucholœops fronto*; *e*, *Pelecyodon arcuatus*; *f*, *Prepotherium moyani*; *g*, *Nematherium* sp.

external covering of cement, which is considerably thinner than in the former, enclosing harder and softer dentine: the different tissues are usually very clearly distinguishable on the worn surfaces. Without exception, the teeth are rootless and remain so throughout life.

(4) The skull, which is curiously small in proportion to the size of the animal, is of quite a constant type throughout the order, though varying much in details, especially in its relative length and in the elongation of the rostrum. In form the skull is long, low and more or less cylindrical, with well arched and quite capacious cranium; the occiput is low and broad and either vertical, or but very slightly inclined forward; the occipital and sagittal crests are never very prominent and may, especially the latter, be entirely absent, but the cranium never has the broad, flat top, produced by the development of the parietal sinuses, which is seen in the great Pampean genera. There is a distinct, but not deep or abrupt

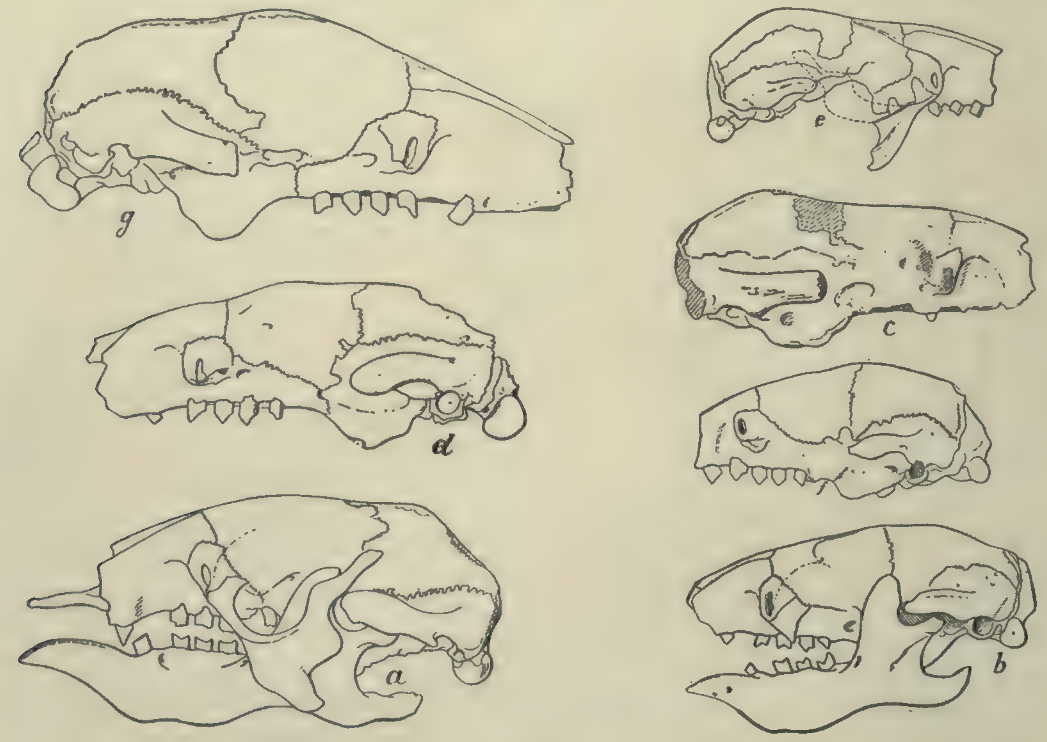

Fig. 16.

Skulls of Santa Cruz Gravigrada, × ½. *a, Hapalops longiceps; b, H. elongatus; c, Megalonychotherium atavus; d, Analcimorphus giganteus; e, Schismotherium splendens; f, Pelecyodon cristatus; g, Planops magnus.*

postorbital constriction and usually a profound preorbital fossa in each maxillary. The zygomatic arch is of very constant character throughout the series; the orbit is widely open behind, the postorbital processes of frontal and jugal being very small or quite absent; the jugal is loosely attached to the skull and has been lost from the great majority of specimens, so that nothing is known of its form, except in the *Megalonychidæ*, in which it resembles that of *Nothrotherium*, having a very conspicuous, plate-like, suborbital process, which descends as low as the ventral border of the mandible; the lachrymal is of mammillary shape and is made very conspicuous by being placed upon the prominent zygomatic process of the maxillary; the foramen is also large and conspicuous, resembling that of *Nothrotherium* in shape and position. The hard palate may have par-

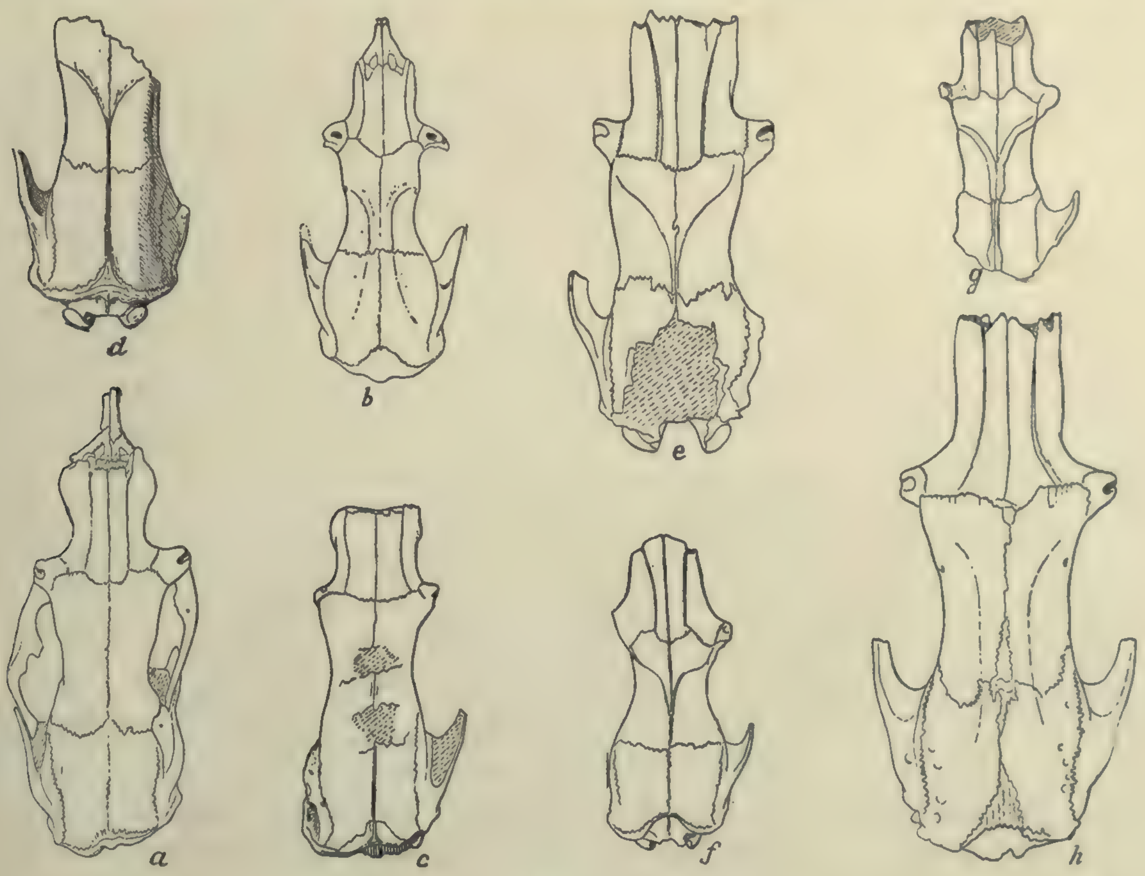

FIG. 17.

Skulls of Santa Cruz Gravigrada, top view, × ⅛. *a, Hapalops longiceps; b, H. ruetimeyeri; c, Megalonychotherium atavus; d, Eucholœops fronto; e, Analcimorphus giganteus; f. Schismotherium fractum; g, S. splendens; h, Planops magnus.*

allel sides, or contract posteriorly; except in the *Planopsidæ*, it is rugose and strongly convex between the molariform teeth, becoming nearly flat anteriorly. The premaxillaries are separate from each other and from the maxillaries and are so loosely attached that they are very rarely found in association with the skull and are known only in a few genera of the *Megalonychidæ;* in this family each premaxillary consists of an anterior and two posterior branches,. which vary much in length and breadth and in the size and shape of the incisive foramina. There is reason to believe that in the other two families the premaxillaries are of quite a different type.

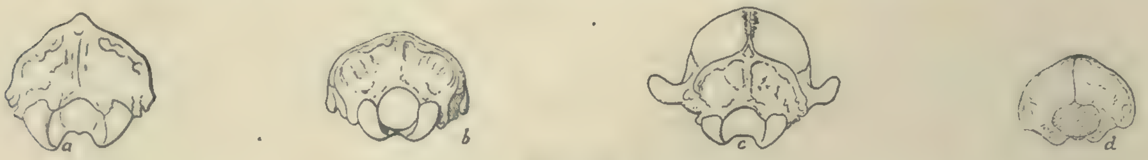

FIG. 18.

Occiputs of Santa Cruz Gravigrada, × $\frac{1}{8}$. *a, Hapalops longiceps; b, Eucholæops fronto; c, Hapalops elongatus; d, Pelecyodon cristatus.*

In the adult animal the two rami of the mandible are coössified at the symphysis, which is extended into a more or less elongate, edentulous spout or beak, the length and shape of which vary greatly, but in all known examples it contracts anteriorly, ending in a point. The dentary portion of the horizontal ramus is usually very thick and massive and its ventral border may be nearly straight (*Mylodontidæ*), strongly convex (*Megalonychidæ*), or may form a great descending flange (certain of the *Planopsidæ*). The condyle is hemispherical and is set upon a long, slender neck, and the angle, which in the *Megalonychidæ* is a very long, prominent and curved hook, and in the other two families is much shorter and broader, is always more or less inflected, somewhat as in the marsupials, but less decidedly and abruptly. The postero-external opening of the dental canal is, with one known exception, large and conspicuous; its usual position is upon the side of the horizontal ramus at the base of the coronoid process, but in most species of *Hapalops* it is in the ascending ramus. The exception noted is the very imperfectly known *Trematherium*, in which the foramen is minute and on the point of disappearance. The foramen never has the position seen in the Pleistocene *Megatheriidæ*.

The hyoid apparatus is but partially known; so far as it is preserved, it bears considerable resemblance to the corresponding parts of *Cholœpus*.

(5) The vertebral column is completely known only in the *Megalonychidæ*, partially in the *Planopsidæ* and not at all in the *Mylodontidæ*. In the first named family the back-bone is very long and the vertebræ very numerous; the vertebral formula has been definitely determined only in one genus, *Hapalops*, but the material is sufficient to prove that in several other genera the formula must have been nearly or quite the same, and there is no reason to suppose that there was any important difference in this respect throughout the family; this formula is: C. 7; Th. 21–22; L. 3–4; S. 5–6; Cd. 20. The epiphyses of the vertebræ remain separate till a comparatively very late period, after those of the long bones have united with the shafts and many sutures of the skull have been obliterated. The neck is of moderate length and no example is known in which the number of cervical vertebræ is more or less than seven; these cervicals are relatively small and weak and are usually in striking contrast to the large and massive lumbars of the same individual.

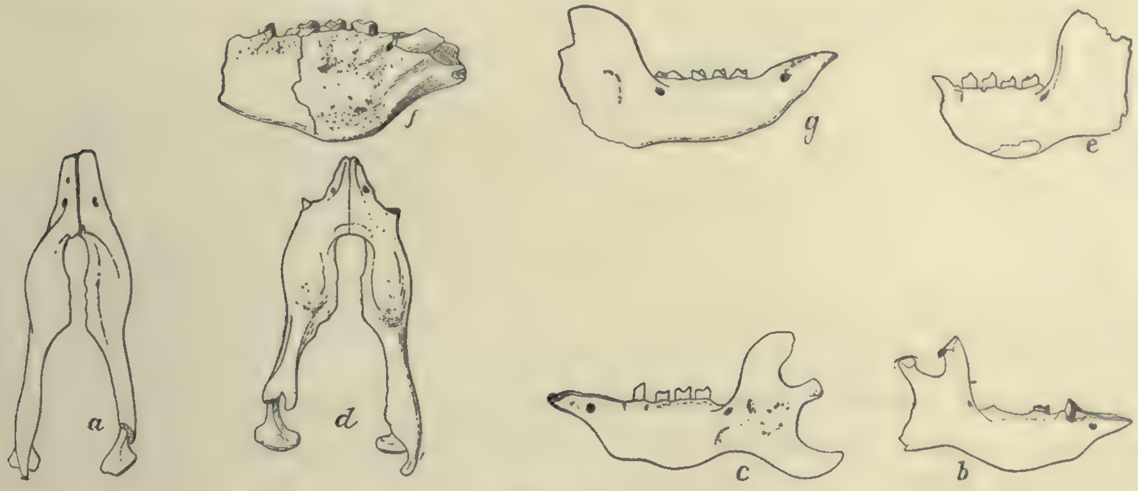

FIG. 19.

Mandibles of Santa Cruz Gravigrada, × $\frac{1}{8}$. *a*, *Hapalops indifferens*; *b*, *H. rostratus*; *c*, *H. elongatus*; *d*, *Eucholæops fronto*; *e*, *Schismotherium splendens ?*; *f*, *Prepotherium moyani*; *g*, *Nematherium* sp.

The trunk, whenever the material is sufficient to permit a judgment upon this point, is remarkably elongate and bears a highly suggestive resemblance to that of *Cholœpus*. The centra, which in the anterior part of the thorax are very small, increase in size posteriorly, becoming quite large in the hinder part of the thoracic and the lumbar regions, and in these same regions they are perforated by a canal, which opens by a single foramen upon the floor of the neural canal and by two large foramina upon the ventral face of the centrum. These foramina vary in size in the different genera and, to some extent, also with age, but are invariably present and conspicuous. The neural spines of all the trunk-vertebræ have a backward inclination, which is much more decided in some genera than in others; they also vary much in length, being disproportionately short in some of the smaller species, but they are always relatively short and slender and thus form one of the most striking contrasts between the Santa Cruz and the Pleistocene Gravigrada. Another notable difference from the latter is in the development of the accessory zygapophyses on the posterior thoracic and lumbar vertebræ. As has already been shown, these processes are quite as complex in the Santa Cruz armadillos as they are in recent genera, but this is not true of the Gravigrada. In the *Megalonychidæ*, so far as they are known, there is only one additional pair of prezygapophyses, which are placed upon projections of the neural arch below the primary pair; the additional postzygapophyses are upon the transverse processes. The *Planopsidæ*, of the Santa Cruz are somewhat further advanced and have added a second accessory pair of pre- and of postzygapophyses in the lumbar region. With the possible exception of the *Mylodontidæ*, concerning which nothing is known in this respect, all the trunk vertebræ are free.

The sacrum is short and generally consists of five vertebræ, of which the first three are intimately connected with the ilia and the last one with the ischia; they have broad, depressed centra and a low, wide neural canal; the neural spines are fused into a continuous ridge, with thickened free border and the zygapophyses are obsolete, except on the first and last.

The tail is of moderate length, but very heavy, especially in the *Planopsidæ*, and tapers rapidly to the end; probably it served as a support when the animal rose upon the hind-legs, as is believed to have been the case in the great Pleistocene forms. The anterior caudal vertebræ are very large and have very long and heavy transverse processes, but posteriorly the vertebræ diminish rapidly in size and all the processes are reduced. A complete series of well-developed chevron-bones is present.

(6) The ribs are usually of only moderate breadth and therefore very unlike those of the great Pleistocene genera, but they are elongate and form a capacious thorax, which is quite different in shape from that of

Cholœpus; all but two or three, at most, of the ribs have prominent tubercles. The sternal ribs are fully ossified and articulate with the sternum by means of well-formed heads and tubercles.

(7) The sternum is of similar type in both *Megalonychidæ* and *Planopsidæ*, and as this type is essentially that of *Mylodon*, it may be inferred that the Santa Cruz *Mylodontidæ* had a sternum of the same character. The manubrium, which varies in form, is a depressed plate and may have an emarginate anterior border, or have a heavy, tongue-like projection from that border; it is provided with short processes for the clavicles. To the segments of the mesosternum, the number of which is not known, Owen's description of the same parts in *Mylodon* will exactly apply. "The bones forming the body of the sternum may be divided into two parts, a broad and flat posterior [dorsal] plate of quadrate form and an anterior [ventral] rhomb or cube projecting from the middle of the plate, and they each present not fewer than ten articular surfaces, two for the contiguous sternal bones and the remaining eight for portions of two sternal ribs" ('42, 54).

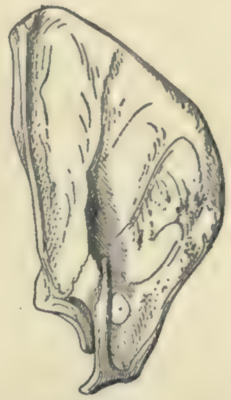

FIG. 20.
? *Hapalops* sp. Right scapula, × ⅛.

(8) Several well-preserved scapulæ have been collected, but most of them were found isolated and cannot be definitely referred to their genera and species. However, they are of very uniform type, varying only in outline and not very strikingly even in that respect. In form, the scapula resembles that of *Cholœpus* rather than that of any of the Pleistocene genera; for most of its length the spine is comparatively low and is so placed as to make the prescapular fossa much larger than the postscapular; the acromion is very long and is united with a process of the coracoid, but this bony bridge or loop does not extend nearly so far below the level of the glenoid cavity as it does in *Cholœpus*. The coracoid is very large, considerably broader in proportion than that of *Cholœpus*, which makes the coraco-scapular foramen smaller; it is connected with the scapula by a suture which persists till a late period, but eventually disappears. The glenoid cavity is relatively small and shallow.

(9) The clavicle, which has been found in connection with only a few species, is rather short and slender, subcylindrical in shape and with a slight sigmoid curvature.

(10) The pelvis is fully known only in the *Megalonychidæ*, in which it is very constant and has considerable resemblance to that of the modern Tardigrada. The ilium has a short, stout peduncle and a large anterior plate, which extends well in front of the sacrum; the acetabular border is external, the ischial and pubic borders internal, in consequence of which the broad gluteal surface has an almost dorsal position and the iliac surface presents ventrally; there is no such expansion and eversion of the ilium as is seen in *Megatherium* and *Mylodon*, a change which invariably accompanies great increase in stature and in the bulk of viscera to be supported.

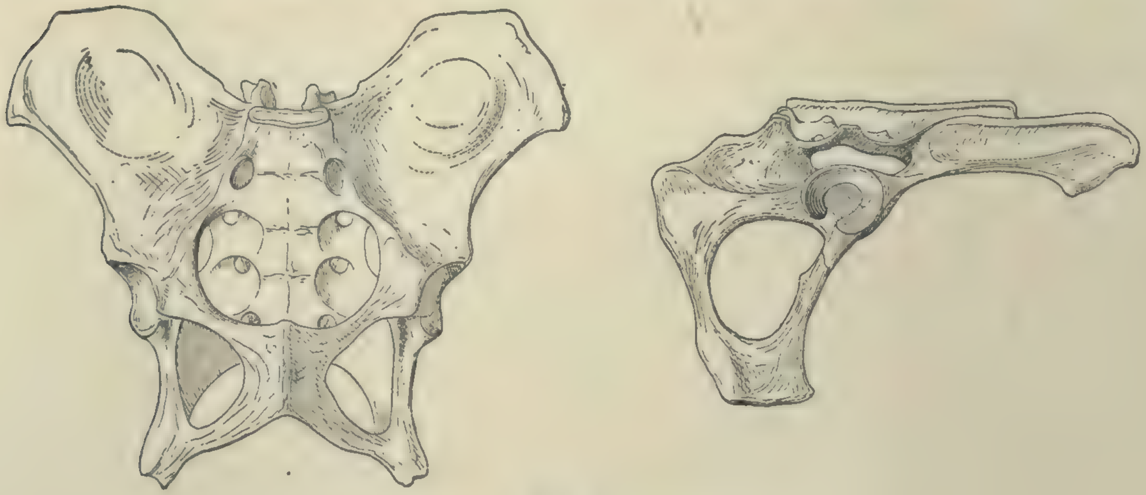

Fig. 21.

Hapalops ruetimeyeri, pelvis from the ventral and right sides, × ⅛.

The ischium is very short antero-posteriorly and its dorsal portion is stout, but the tuberosity is small; the descending process is long and slender and the ischium thus encloses two sides of the very large obturator foramen, the principal diameter of which is dorso-ventral; the sacrosciatic foramen is much smaller than in the later types and its longer axis is antero-posterior. The pubis is elongate, slender and subcylindrical, except near the distal end, where it becomes compressed and plate-like; the short symphysis is formed by both pubes and ischia; near the proximal end of the pubis is in some species a low rugose process, corresponding to that in the glyptodonts. The great dorso-ventral extension of the pubes and ischia, though less exaggerated than in some of the Pleistocene genera, makes the pelvic opening very large in this diameter. The acetabulum is large and has very prominent borders, but the very large sulcus for the round ligament reduces the articular surface to a comparatively narrow band.

(11) The limb-bones are, to a certain extent, intermediate in their proportions between those of the Pleistocene Gravigrada and those of *Myrmecophaga*, being relatively shorter and heavier than in the latter, more elongate and slender than in the former, among which *Megalonyx* and *Nothrotherium* have limb-bones most resembling those of the Santa Cruz types. There are also many points of resemblance to the corresponding parts of the existing Tardigrada.

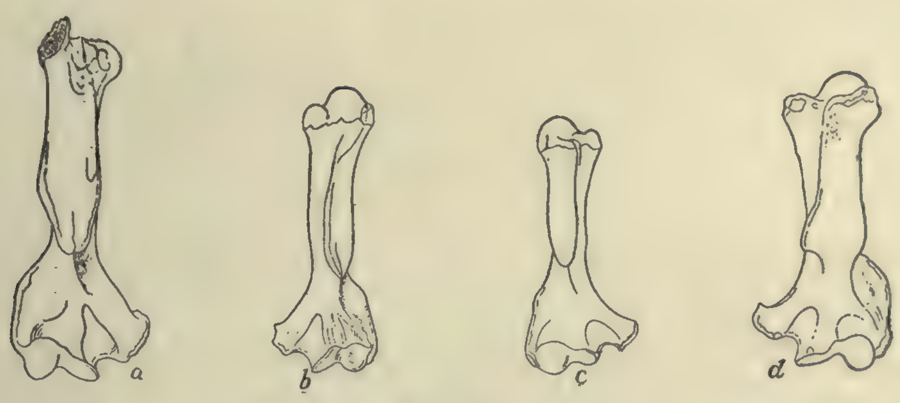

FIG. 22.

Humeri of Santa Cruz Gravigrada, × ¼. *a*, *Hapalops longiceps*; *b*, *H. ruetimeyeri*; *c*, *Pelecyodon arcuatus*; *d*, ? *Nematherium* sp.

(12) The humerus is very constant in its characters among the Santa Cruz representatives of all three families and is very similar to that of *Megalonyx* and *Nothrotherium*. The head is small and sessile, the tuberosities are of subequal size, the shaft elongate, subcylindrical and slender, except at the distal end, the deltoid area very large and prominent; the distal end is much expanded and antero-posteriorly compressed, and bears a very prominent epicondyle and supinator ridge; the entepicondylar foramen is invariably present, while in all the Pleistocene genera, except *Nothrotherium*, this foramen is absent. The humerus attributed to the Santa Cruz *Mylodontidæ* differs only in being somewhat shorter and stouter.

(13) The ulna has a rather stout, laterally compressed shaft, tapering to the distal end and with distinct sigmoid curvature; the olecranon is quite small and straight, without transverse expansion.

(14) The radius has a discoidal or transversely oval head and a remarkably limited proximal facet for the ulna, the position of which seems to indicate that the radius was habitually carried in front of rather than internal to the ulna; the proximal portion of the shaft is slender and of transversely oval section, while, for the distal two thirds, it is very much broader and of trihedral shape. In *Megatherium* the radius is very similar.

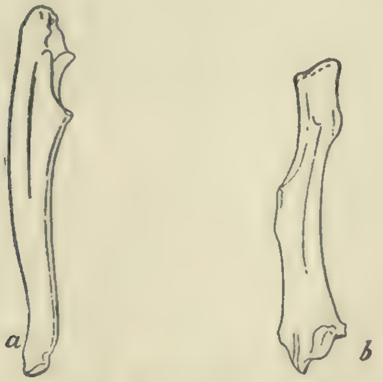

FIG. 23.

Hapalops longiceps, *a*, left ulna, × ¼. *b*, left radius, × ¼.

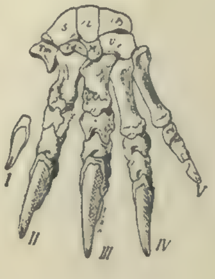

FIG. 24.

Hapalops longiceps, left manus, × ¼.

(15) The manus is most like that of *Megalonyx* and *Nothrotherium*, though considerably less specialized; all its parts are free and no element has been lost. The proximal line of the carpus is transverse and not oblique to the axis of the limb; the scaphoid rests upon the trapezium and trapezoid, but not upon the magnum, while the lunar rests upon the latter, but not on the narrow unciform. Five digits are present, all functional and provided with claws, though the median three digits, II, III, IV, are considerably longer and heavier than the laterals, I and V. None of the phalanges are coössified, and they are present in unreduced number in all the digits. In the *Megalonychidæ* the ungual phalanges are very long and sharp, much compressed and decurved, and more or less deeply cleft at the distal end, while in the manus of the *Planopsidæ* they are of a quite different shape, being much broader, more strongly decurved and depressed, more bluntly pointed and with shallow distal cleft; in both groups the subungual processes are very large and the bony hood or lamina at the base of the claw is well developed, though less extensively than in the Pleistocene genera.

So far as the manus itself is concerned, there is little in its structure to indicate that the gait was other than simply plantigrade, but the articular surfaces which enter into the elbow joint do not agree very well with such an inference, rather indicating that the hand was already applied to the ground by its ulnar border, at least in an incipient degree.

(16) The femur is short and heavy and almost always strongly compressed and flattened antero-posteriorly, especially in the *Planopsidæ*, but in at least two genera, *Schismotherium* and *Analcimorphus*, the shaft is much more rounded and less compressed; the third trochanter is present in every known specimen, but is much reduced in *Prepotherium;* the great trochanter is low, but very massive and the digital fossa is extremely small; the condyles usually resemble those of *Megalonyx* and the rotular trochlea is broad and shallow.

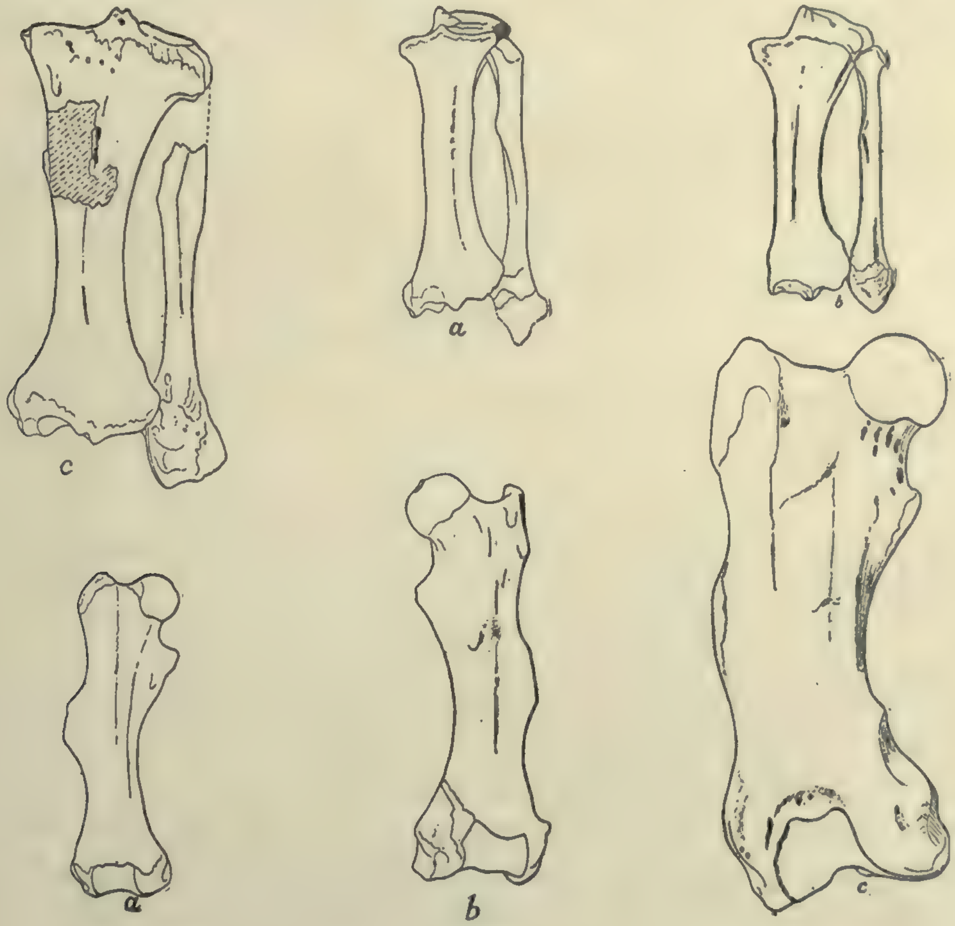

FIG. 25.

Bones of the hind limb of Santa Cruz Gravigrada, × ¼. *a*, *Hapalops* (femur of *H. elongatus*, tibia and fibula of *H. longiceps*); *b*, *Analcimorphus leptocephalus*; *c*, *Prepotherium potens.*

(17) The patella is almond-shaped and of no great thickness.

(18) The tibia and fibula are never coössified. The tibia is short and heavy, but much less so than in the Pleistocene genera; the proximal end is antero-posteriorly compressed and has widely separated facets for the femoral condyles; the shaft is arched forward and the cnemial process, though heavy and rugose, is inconspicuous; the distal end is broad and much compressed antero-posteriorly; the inner malleolus is very small, but internally to it there arises a prominent process, which is grooved by a tendinal sulcus; the astragalar surface varies considerably in the different families and genera.

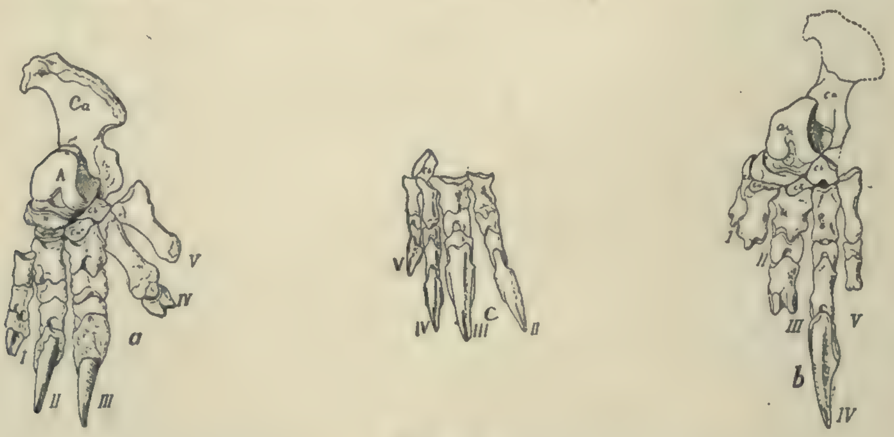

FIG. 26.

Pes of Santa Cruz Gravigrada, × ¼. *a, Hapalops longiceps; b, Analcimorphus leptocephalus; c, Pelecyodon arcuatus.*

(19) The fibula is stout and straight, with subcylindrical shaft and extremely massive distal end, which has no contact with the calcaneum.

(20) The pes, though known in only a few genera, displays considerable variety of structure. In the *Megalonychidæ* the astragalus is essentially similar to that of the Pleistocene members of the family; it is relatively narrow and elongate, with trochlea which may be but slightly or quite distinctly grooved; the neck is very short and the navicular facet is concave. In the *Planopsidæ*, as represented by *Prepotherium*, the astragalus is of quite a different type, being shorter and much broader and with quite deeply grooved trochlea; the inner condyle is short and strongly convex and projects prominently toward the internal side, thus displaying in an incipient stage the odontoid form of this condyle seen in *Megatherium* and *Mylodon*.

In the *Megalonychidæ* the calcaneum resembles that of *Megalonyx* and *Nothrotherium*, especially in the broad, depressed, curved and plate-like tuber; the sustentaculum is not very prominent and its facet for the astragalus presents almost distally, so as to be nearly parallel with the surface for the cuboid; the latter surface is quite concave and of subcircular shape, covering the entire dorso-plantar diameter of the distal end. In *Prepotherium* the calcaneum displays some significant differences; the tuber is not notably different, being a similar broad, depressed and curved plate, but the sustentaculum is very much more prominent and its facet for the astragalus presents dorsally, at right angles to the plane of the cuboid facet; the latter is remarkably narrow in the dorso-plantar dimension and below it is a thickened mass of bone. Doubtless, these differences indicate that *Prepotherium* had already begun to rest the weight in walking upon the fibular border of the hind-foot.

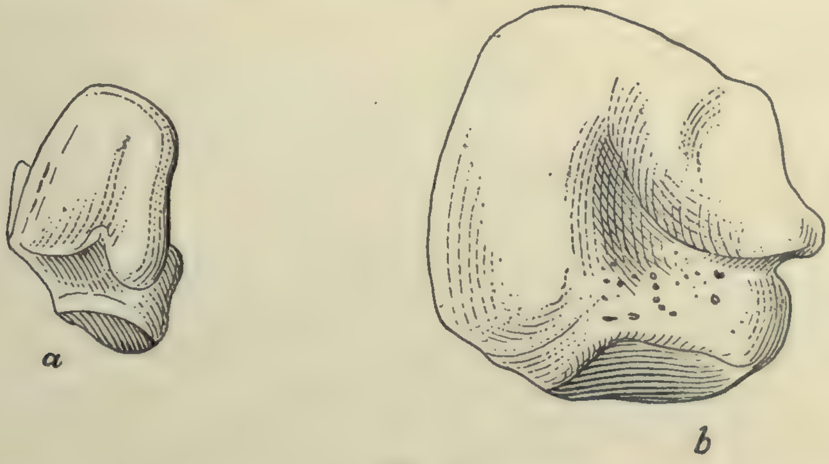

FIG. 27.
Dorsal side of right astragalus, nat. size. *a*, *Hapalops elongatus*; *b*, *Prepotherium potens*.

The remainder of the pes is known in only a few genera of the *Megalonychidæ*, such as *Hapalops*, *Analcimorphus* and *Pelecyodon*, and shows an unexpected amount of difference between them, which, however, is chiefly confined to the relative proportions of the digits. The tarsal bones are all present and unankylosed and the digits number five, all functional and bearing claws. In *Hapalops* the three radial metatarsals (I–III) are very short, and II and III are extremely heavy, while IV and V are much more slender and elongate; V gives off from the proximal end of the fibular border a very large and prominent process, as in *Megalonyx*, in which the metatarsals are far heavier, but retain their relative proportions. In *Analcimorphus* and *Pelecyodon*, on the other hand, the difference in length is very much less marked; II and III are, it is true, much stouter than IV and V, but they are not strikingly shorter, and V has no such development of the proximal process as in *Hapalops*.

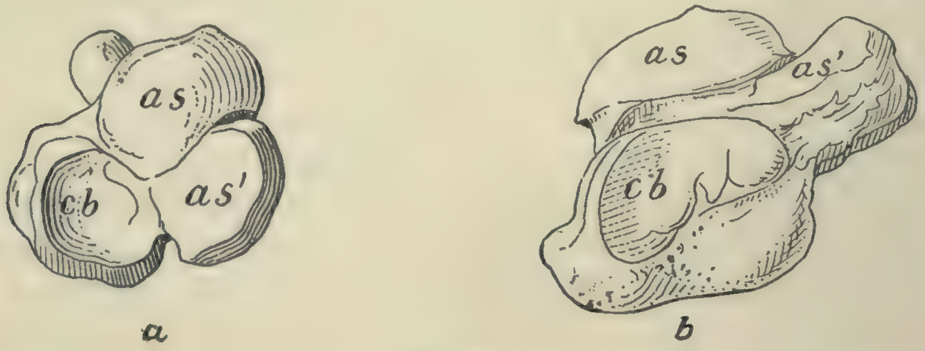

FIG. 28.

Distal end of right calcaneum, nat. size. *a*, *Hapalops elongatus*; *b*, *Prepotherium potens*. *as*, external astragalar facet; *as'* internal astragalar, or sustentacular facet; *cb*, cuboid facet.

The phalanges, which are all free, resemble those of the manus, but the unguals are considerably smaller.

The systematic arrangement of the Santa Cruz Gravigrada offers an exceedingly puzzling and difficult problem. At that period the entire group would appear to have been in a state of flux, as though the types had not yet been definitely fixed, and I know of no series of fossil mammals which so strongly suggests indefinite variations, from which a comparatively small number were chosen and fixed by natural selection. Not only is there a great number of types, but these types are also, within comparatively narrow limits, singularly variable and inconstant, so that it is exceptional to find two individuals which are clearly and unequivocally referable to the same species, and every imaginable transition may be found. To depend upon the usual criteria, would result in the formation of a different species for almost every specimen and the number of species, already very large, would be greatly increased by the Princeton and New York collections, in which few individuals agree at all closely with those in the collections of Dr. Ameghino and the La Plata Museum. Differences of age may perhaps account for some of these variations and others may possibly be due to sex, for there are, in a few instances, indications of secondary sexual characters, but the analogy of the recent edentates does not encourage us to expect any very notable sexual differences in the fossil skeletons. Even less than usual is it possible to be consistent in the employment of specific and generic criteria; a character which in one group is altogether variable and of no taxonomic value, may in another be quite constant and prove of much assistance in distinguishing the species. While the genera may, as a rule, be separated without great difficulty, the only practicable course, in the present state of knowledge, is to regard the species as vague and elastic groups, partly on account of their variability and partly because so many have been established upon fragmentary remains. The satisfactory taxonomic arrangement of the Santa Cruz Gravigrada must await the gathering of much more extensive collections. I have attempted in the following pages to furnish the reader with material adequate to an independent judgment of these questions.

Attention has already been called to the fact that the Gravigrada of the Santa Cruz beds have great phylogenetic importance and that representatives, if not actual ancestors, of almost all the Pleistocene genera may be found in this fauna. It should be observed, however, that the number of Santa Cruz genera much exceeds that of the Pampean types, most of the former having died out without successors. As examples of this may be cited *Eucholœops*, *Analcimorphus*, *Pelecyodon*, and many others. On the other hand, several of the genera may well have been the direct ancestors of later forms. The Pleistocene *Nothrotherium* might be sufficiently described as *Hapalops* with the dental formula reduced to $\frac{4}{3}$ and with the pterygoids curiously inflated. It is extremely probable that the North American *Megalonyx* is descended from some of the Santa Cruz *Megalonychidæ*, for there is the closest correspondence between them in all parts of the skeleton; the Pleistocene genus is very much larger and more massive and the skull has undergone considerable modification, but otherwise there is singularly little change. Among the Santa Cruz representatives of the family, the one most likely to prove the desired ancestor is *Megalonychotherium*, which already displays the characteristic type of dentition, but this genus is still too incompletely known for certainty in the matter.

It is extremely unfortunate that the *Planopsidæ* and *Mylodontidæ* are so rare and are represented in the collections by such incomplete specimens. Under these circumstances it is impossible to decide questions of phylogeny with any degree of confidence. So far, however, as the evidence extends, there is much reason to believe that *Prepotherium* is nearly allied to the ancestor of *Megatherium*, and that *Nematherium* and *Analcitherium* were the fore-runners of *Mylodon*, *Lestodon* and *Scelidotherium*.

Finally, should be remarked another notable difference between the Santa Cruz Gravigrada and those of the Pampean. In the former epoch the *Megalonychidæ* were the dominating family, which included the greater number of genera and species and the overwhelming majority of individuals, while the other two families are so rarely found that they must have formed but an inconspicuous element of the fauna. In Pampean times, on the contrary, most of the *Megalonychidæ* had become extinct and the *Megatheriidæ* and *Mylodontidæ* had greatly increased and assumed the dominating position.

MEGALONYCHIDÆ.

In the Santa Cruz epoch, at least in Patagonia, this was the characteristic family of Gravigrada, far outnumbering in genera, species and individuals both of the other families combined, and it is the only one of the three in which the skeletal structure is at all completely understood, but enough is known of the other two families to display many of their contrasting characters. The present family includes many very small species, the smallest of the known Santa Cruz ground-sloths, as well as some of the largest, with every intermediate gradation of size. The teeth are non-lobate and may be arranged in continuous series, or, as is much more common, with the first tooth in each jaw isolated by diastemata and, though varying much in size and shape, always more or less distinctly caniniform; $\underline{1}$ is usually implanted in the jaw near the maxillo-premaxillary suture, but in a few genera is placed considerably behind that suture. The molariform teeth are most frequently of transversely oval form, but are often rectangular or subtrihedral.

The skull is elongate and cylindrical, usually with deep postorbital constriction and preorbital fossæ. The sagittal and occipital crests vary much in development and, though never very prominent, may be quite distinct, very faint, or quite obsolete. The premaxillaries, which differ greatly in length, are yet of a nearly uniform type; each is composed of three branches, which are almost always slender and rod-like, but in *Hyperleptus* form broad, tapering plates, with minute incisive foramina. The palate is very rugose and between the molariform teeth is strongly convex. The mandible has an edentulous beak or spout, which varies remarkably in length and shape, even in the same genus; the condyle is set upon a very long, slender neck and this, together with the high coronoid and the very long angular process, gives to this part of the mandible a characteristically trifid appearance.

The neck is elongate and slender, with small and rather weak vertebræ. The trunk, and especially the thoracic region, is very long and has numerous vertebræ, in some cases at least, as many as 25; the loins are short and heavy; the articular processes in the lumbar and posterior thoracic regions are relatively simple, only one additional pair each of pre- and postzygapophyses being present. The tail is stout, but not so massive as in the *Planopsidæ*.

Compared with those of the other two families, the limb-bones are rather slender. The manus has very long, compressed and sharp ungual phalanges, especially on the median three digits. The femur invariably has a prominent third trochanter. The astragalus is relatively long and narrow, moderately or faintly grooved and rarely shows any tendency for the inner condyle to assume the odontoid shape. The calcaneum has a short sustentaculum, the astragalar facet of which presents distally and is nearly parallel to the facet for the cuboid, which is large and circular. The phalanges are heavier than those of the manus, but the unguals are shorter. There is no apparent reason to doubt that the pes was plantigrade and that the entire plantar surface was applied to the ground, unless the partial displacement of the cuboid to the plantar side of the astragalus should be regarded as such a reason.

HAPALOPS Ameghino.

(Plates XXX–XLV.)

Hapalops Amegh.; Enumeracion sistematica, etc., 1887, p. 22.
Eucholœops Amegh., in part; Ibid., p. 21.
Xyophorus Amegh.; Ibid., p. 23.
Parhapalops Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 318.
Pseudhapalops Amegh.; Ibid., p. 319.
Amphihapalops Amegh.; Ibid., p. 319.
Geronops Amegh.; Ibid., p. 320.
Eugeronops Amegh.; Ibid., p. 397.
Schismotherium Mercerat (*non* Ameghino); Rev. del Museo de La Plata, T. II, 1891, p. 5.

Stenocephalus Mercerat; Ibid., p. 10.
Tapinotherium Mercerat; Ibid., p. 17.
Eurysodon Mercerat; Ibid., p. 18.
Eleutherodon Mercerat; Ibid., p. 24.
Amarorhynchus Amegh.; Énum. Synopt. de Mamm. Foss. de Patagonie; 1894, p. 147.
Mecorhinus Amegh.; Ibid., p. 156.
Pseudhapalops Lydekker, in part; Anales del Museo de La Plata; T. III, 1894, p. 100.

As the *Megalonychidæ* are to the other families of Santa Cruz Gravigrada, so is *Hapalops* to the other genera of the *Megalonychidæ*, incomparably the most abundant and the most varied; much more than half of all the ground-sloths contained in the collections of Santa Cruz fossils are referable to this genus. Future research may show that the formidable list of synonyms should be reduced, for several of these supposed genera have been established upon fragmentary and uncharacteristic types, and better preserved specimens may prove that more or fewer of them are entitled to generic distinction.

There is a remarkable difference of size among the species of *Hapalops*, ranging from some of the smallest to some of the largest contemporary members of the family, and in the different species, so called, there is the greatest variability in this respect, giving an almost complete series of transitions from one extreme to the other.

The dentition is fairly constant and characteristic; the first tooth in both upper and lower jaws is in the same fore-and-aft line as the other teeth and is isolated by a diastema of varying length; it is quite small, caniniform and, in most instances, obliquely worn; in shape it may be cylindrical, obscurely trihedral, or laterally compressed; $\underline{1}$ is implanted near the premaxillary suture. The molariform teeth are subquadrate, transversely oval, or faintly trihedral, somewhat as in *Megalonyx*. The skull is elongate and generally narrow; the occipital and sagittal crests are never very distinct and may be entirely absent, and in almost all the species the supra-occipital is reflected over upon the roof of the cranium for a considerable distance. The facial part of the maxillary extends beyond $\underline{1}$ as a thin plate and forms the side wall of the anterior nares, without any thickening of the margin. The premaxillaries vary greatly in length, but are always composed of an anterior, slender branch and two widely separated posterior branches, of which the external one is broader and flatter. The edentulous beak of the mandible varies in correspondence with the length of the premaxillaries, but always contracts forward gradually and is not deeply constricted in front of $\overline{1}$; the postero-external opening of the dental canal varies much in position; it is usually in the ascending ramus, but in several species is in the horizontal ramus at the base of the coronoid. The latter position has been used by Ameghino as the distinguishing mark of *Pseudhapalops*, but transitions are not wanting, as is shown in the mandible figured in Plate XL, fig. 4, and in text-figure 19^c, p. 167.

The vertebral formula is: C. 7; Th. 21–22; L. 3–4; S. 5–6; Cd. ± 20. The neural spines of the trunk-vertebræ are short, straight and, especially in the hinder portion of the trunk, are plate-like and broad antero-posteriorly.

The manus does not differ very markedly from that of other contemporary members of the family in which the fore-foot is known, its principal characteristic being the elongation of metacarpals IV and V. The femur is broad and much compressed antero-posteriorly and the pes is quite characteristic. Metatarsals IV and V are much longer and more slender than II and III and there is an extremely prominent process on the fibular border of the proximal end of V.

The species of *Hapalops* are very numerous, but the problem concerning the number and limits of these species cannot be solved with the available material. What has already been said as to the extreme difficulty of the taxonomic arrangement of the Santa Cruz Gravigrada applies with particular force to this genus, in which variability is so remarkable. The arrangement adopted in the following pages is to be regarded as merely tentative and subject to revision as more complete specimens are obtained.

Relationships. That *Hapalops* is nearly related to both *Nothrotherium* and *Megalonyx* is abundantly clear from a cursory examination of the skeleton, all parts of which are very similar to those of the two Pleistocene genera. In fact, there is every reason to believe that *Nothrotherium* was the direct descendant of some species of this genus. On the other hand it is probable that *Megalonyx* was derived, not from any Santa Cruz species of *Hapalops*, but from a closely allied contemporary genus, *Megalonychotherium*.

HAPALOPS LONGICEPS sp. nov.

(Plates XXX–XXXIII.)

This is one of the largest known species of this variable genus and is characterized by the great elongation of the rostrum; the premaxillaries and the edentulous beak of the mandible being much longer than in any other known species. The species is described first, because the type-specimen (No. 15,523) is much the most complete single individual that has yet been found and forms a convenient standard of reference for the other species.

Dentition (Plates XXXI, figs. 1, 2; XXXII, fig. 2). The teeth differ but little from those of the other representatives of the genus; $^{\underline{1}}$ is, as usual, small, caniniform, obscurely trihedral, inserted just behind the maxillo-premaxillary suture and separated from $^{\underline{2}}$ by a considerable diastema. The other upper teeth ($^{\underline{2-5}}$) are molariform; $^{\underline{2}}$ is subquadrate, with rounded angles; $^{\underline{3}}$ is considerably larger and more trihedral, $^{\underline{4}}$ is more rectangular and $^{\underline{5}}$ is very small, obliquely worn and without transverse valley; on the posterior face of $^{\underline{5}}$ is a shallow, vertical groove, which causes a faint bilobation.

In the lower jaw $_{\overline{1}}$ is caniniform, but smaller than $^{\underline{1}}$ and more erect, rising higher than the other mandibular teeth, and separated from $_{\overline{2}}$ by a shorter diastema than that of the upper jaw; $_{\overline{2}}$ and $_{\overline{3}}$ are transverse and rectangular, and their raised margins are quite deeply notched on the inner and outer sides by the transverse valley; $_{\overline{4}}$ is subcylindrical, as in most of the other species.

MEASUREMENTS.

Upper dentition, length	.058	$^{\underline{5}}$, width	.008
" " " $^{\underline{2-5}}$	.035	Lower dentition, length	.044
Diastema, length	.015	" " " $_{\overline{2-4}}$	.029
$^{\underline{1}}$, length (*i. e.* ant.-post. diameter)	.008	Diastema, length	.012
" width (*i. e.* transverse diameter)	.007	$_{\overline{1}}$, length	.006
$^{\underline{2}}$, length	.007	" width	.005
" width	.010	$_{\overline{2}}$, length	.0075
$^{\underline{3}}$, length	.008	" width	.0105
" width	.011	$_{\overline{3}}$, length	.0085
$^{\underline{4}}$, length	.007	" width	.010
" width	.0105	$_{\overline{4}}$, length	.009
$^{\underline{5}}$, length	.0055	" width	.010

Skull (Plates XXXI, XXXIII, fig. 1). When seen from the side, the skull is long and low; its upper contour rises quite steeply from the occipital crest to the parietal eminence, which is on a line with the glenoid cavity; forward of this, the contour becomes concave at the postorbital constriction, whence it rises and becomes convex at the frontal sinus, descending again very gradually to the muzzle. The cranium is long and the face short, though much less shortened than in most other species of the genus, a difference due chiefly to the relative development of the premaxillæ and the mandibular beak, which in the present species are very much as in the Pleistocene genus *Nothrotherium* (*Cœlodon*).

As a whole, the occiput (Plate XXXIII, fig. 1) has a shape resembling that of *Megalonyx*, but is inclined gently backward instead of forward; it has a broad median vertical prominence, with a broad, shallow fossa on each side of it; the prominence projects quite strongly above the foramen magnum, making the latter present downward rather than backward. The crest is distinct but not prominent. All the elements of the occiput have coalesced and the sutures are no longer visible, but the shape of these bones may be inferred from a comparison with other species. The basioccipital is narrower and more convex than in *Nothrotherium* and on its posterior half are two lateral fossæ separated by an ill-defined median ridge. The condyles are conspicuously larger than in the Pleistocene genus, but not so widely separated; they are also broader transversely and taper more to the external ends. The exoccipitals are low and broad, forming relatively little of the occipital surface, and the paroccipital processes are almost obsolete. The supraoccipital is large and is reflected quite extensively upon the roof of the cranium, between the divergent parietals.

The mastoid portion of the periotic is exposed on the surface of the skull, but is not demarcated by fossæ from the exoccipital and squamosal, as it is in many other species of this genus; a short but well defined mastoid process is present, with distal facet for the hyoid.

As usual, the parietals are very large; they have no sagittal crest, except near the anterior end, where the crest is very low, but quite distinct. The temporal surface is everywhere convex, in marked contrast to most of the Pleistocene genera, in which this surface is more or less concave. The frontals are long and are made convex by the sinuses, with a moderate depression along the median line; the postorbital constriction is well marked and in this region the frontals bear the sagittal crest, which is longer than the parietal portion; the crest does not bifurcate anteriorly into temporal ridges. No definite postorbital process is formed, but its position is indicated by a small vascular foramen, which differs from that of *Nothrotherium* in presenting laterally instead of dorsally. The nasal suture is slightly concave, but there is no distinct nasal process.

The nasals are narrow and moderately elongate, extending to the anterior rim of the orbit, while in *Nothrotherium* they excavate the frontals much more deeply and reach almost to the middle of the orbit. These bones are moderately convex in both directions and anteriorly each one is cut by a deep, narrow notch, forming thus a long, slender lateral process, which accompanies the maxillary to the edge of the anterior nares; the median portion of each nasal is shorter and abruptly truncate at the end, so that the sides of the narial opening extend considerably farther forward than the roof, which is broadly emarginate. In *Nothrotherium*, on the other hand, the medial portion of the nasal is the longer, extending well beyond the maxillaries. The anterior nares are quite small and rudely semicircular, though somewhat higher than wide.

The premaxillaries are strikingly like those of *Nothrotherium* as figured by Reinhardt ('78, Tab. I, fig. 3) and are therefore very unlike those of the other Pleistocene genera. Each of these bones is Y-shaped and consists of three long and slender branches; the anterior branch is very unusually elongate, which sharply distinguishes this species from all the other members of the genus; it extends horizontally forward, ending in a bluntly rounded point and is closely applied to its fellow of the opposite side. Of the two posterior branches, the median one is simply a backward continuation of the anterior branch and forms the premaxillary spine, while the lateral branch curves strongly outward and articulates with a shallow depression of the maxillary just in front of the first tooth. The incisive foramina are relatively large, triangular openings, which have an oblique position and are quite widely separated by the spines.

The maxillaries are very large and the preorbital portion is relatively shorter and higher than in *Nothrotherium*, but longer and lower than in the other Pleistocene genera, and ends abruptly in front of the first tooth, with a thin edge; the alveolus of $\underline{1}$ forms quite a prominent, curved swelling upon the side of the jaw and between this prominence and the orbit is a deep fossa, which is a very conspicuous feature of the skull, when viewed from above or below. The depth of this fossa varies much in the different species of *Hapalops*, but is almost obsolete in *Nothrotherium*, in which the first tooth has been suppressed. The dorsal border of the maxillary is curved, not straight as it is in the last named genus, and the anterior edge is nearly vertical; between the lachrymal and the nasal the maxillary forms a short, transverse suture with the frontal. The alveolar border is straight and nearly horizontal. The palatine processes are long and narrow and in this individual are indistinguishably fused with the palatines and with each other. The hard palate is elongate and narrow, strongly convex and very rugose between the molariform teeth, but becoming quite flat anteriorly, and everywhere perforated by numerous vascular foramina. In the edentulous space there is a well-defined groove on each external side, with raised outer border. The median anterior notch to receive the premaxillary spines is quite small and of a broadly open U-shape.

The limits of the palatines cannot be made out. From the analogy of other species it may be inferred that they form little of the hard palate and are extended as large, vertical plates on each side of the posterior nares. The pterygoids are narrow, inconspicuous plates, closely applied to the descending processes of the alisphenoids, and not in the least like the swollen, bulla-like bones of *Nothrotherium*, which Reinhardt has described ('78, 336). The posterior nares resemble those of the last-named genus in shape, but they are narrower anteriorly, extend farther forward, to the line of the last tooth, but not so far backward, and with very different side-walls on account of the different character of the pterygoids and the much larger share taken by the alisphenoids in their formation.

The lachrymal is a large, mammillate bone and, carried upon the zygomatic process of the maxillary, forms a conspicuous prominence on the face and extends dorsally to the frontal. It agrees closely with that of *Nothrotherium*, but has a larger and more slit-like foramen.

The jugal, on the whole, most resembles that of *Nothrotherium*; anteriorly it is expanded and articulates by an apparently movable joint with the maxillary and lachrymal; the dorsal border of the anterior half of the bone is concave, describing nearly a semicircle and flared outward, to form the rim of the orbit; the postorbital process is a low and rounded, but distinct angulation, while in the Pleistocene genus there is no trace of it. The postorbital part of the jugal is much longer and more horizontal than in the latter; the suborbital process is a long, laterally compressed plate, with convex anterior and concave posterior border, making it somewhat recurved; it is narrower than in *Nothrotherium*, except at the distal end, which has no such emargination of the hinder border.

The zygomatic process of the squamosal is also much like that of the Brazilian genus; it is short, laterally compressed and nearly straight, and projects but moderately from the side of the skull; its base is inflated by a large sinus and notched by the external auditory meatus; the glenoid cavity is a large and deep oval pit, without definite postglenoid process. The cranial portion of the squamosal is long and low, extending from the occipital crest to the frontal.

The mandible differs strikingly from that of any of the known Pleistocene genera. For most of their length, the short horizontal rami are well separated and form a broad jaw, but in front of the teeth they curve sharply inward to the symphysis, where they are completely fused together. The predentary part of the mandible forms an unusually elongate, narrow and bluntly pointed spout or beak, with thin and much elevated lateral borders, so that the dorsal surface is deeply concave; this spout is longer than in any other known species of the genus. The ventral border of the jaw is strongly sinuous, much more so than in *Nothrotherium*, convex below the teeth and concave behind them, again becoming convex at the angle. Between the first and second teeth the alveolar border is constricted and below this, on the outer side, is a large and deep pit. The coronoid process arises from the outer side of the ramus, leaving a broad groove between itself and the last tooth; it is high, compressed and recurved and shaped much as in *Megalonyx*. A broad and deep sigmoid notch separates the coronoid from the condyle, which, as in the latter genus, is set upon a long and slender neck; it is large, hemispherical, with convex dorsal surface and deeply excavated ventral side. The angular process is a very large hook, similar in shape to that of *Megalonyx*, though longer and narrower; the inflection of the angle, found in all the Santa Cruz Gravigrada, is especially well marked in the present species. As in the last-named genus, the hinder part of the jaw has a trifid appearance, the coronoid, condyle and angle being quite symmetrically placed and of nearly equal lengths, while in *Nothrotherium* the small angle gives a very different appearance to this part of the jaw. The postero-external opening of the dental canal pierces the ascending ramus above the base. On the left side the foramen is double, doubtless an abnormality.

MEASUREMENTS.

Skull, length in median basal line	.173
Skull, length in median line to anterior border of maxillary	.137
Skull, extreme length	.189
Cranium, length to anterior rim of orbit	.118
Face, length from orbit to anterior nares	.048
Face, length from orbit to end of premaxillary	.083
Occiput, height	.047
" width at base	.062
Cranium, width at postorbital constriction	.033
Cranium, width over lachrymals	.065
Zygomatic arch, length	.090
Jugal, length of descending process	.036
Length, occipital condyle to glenoid cavity	.028
Length from occipital condyle to last tooth	.077
Palate, length in median line (exclusive of premaxilla)	.060
" width at $\underline{1}$	.025
" " " preorbital fossæ	.028
" " " $\underline{2}$	.017
" " " $\underline{5}$	.013
Mandible, length	.140
" " of predentary beak	.049
" " from condyle to $\overline{4}$	.065
" depth at $\overline{3}$	.028
" thickness at $\overline{3}$	.018
" height of coronoid	.064
" " " condyle	.045

Vertebral Column and Ribs (Plate XXX).—The vertebral column, though well preserved, is not sufficiently complete to show the exact number of vertebræ in each of the different regions, but it is highly probable that the formula was as follows: C. 7; Th. 22; L. 3; S. 6; Cd. 20±. The neck about equals the skull in length and is quite slender, though relatively heavier than in some of the smaller species. The atlas differs from that of all the Pleistocene genera in which this vertebra is known, and is most like that of *Mylodon*, but is relatively longer antero-posteriorly, narrower transversely and shallower dorso-ventrally; the anterior cotyles, which are deeply concave, are not so widely separated as in the last-named genus, and between them the inferior arch is deeply notched, more so even than in *Megatherium;* the posterior cotyles are quite large and sessile. The neural arch is thin and but moderately curved and the spine is represented by a very small tubercle; the foramina for the first pair of spinal nerves are large and perforate the arch near the anterior border. The inferior arch is narrower and shorter, but thicker and more curved than the neural and has a hypapophysial tubercle; the large facet for the odontoid process of the axis is continuous with the posterior cotyles. The neural canal is lower and wider than in *Mylodon*, but ventrally becomes much narrower, and the tubercles for the attachment of the transverse ligament are not conspicuous. The transverse processes most resemble those of *Mylodon*, having an almost semicircular free border, making the greatest breadth of the vertebra in the middle of its course and not at the hinder border; in front the processes extend to the border of the anterior cotyles, from which they are separated by notches in the Pleistocene genus; the hinder margins do not extend beyond the posterior cotyles, as they conspicuously do in *Mylodon*. The posterior opening of the vertebrarterial canal has a somewhat more forward position than in the latter, in which the foramen is concealed when the vertebra is seen from above; the canal divides almost immediately, one branch piercing the neural arch and the other passing forward and downward through the transverse process and opening on the ventral side; in front of this ventral opening is another canal which perforates the transverse process obliquely forward and upward. Among the Pleistocene Gravigrada *Megalonyx* most resembles the present species in the course of these canals.

The axis has a short, wide, depressed centrum, with ventral keel terminating in a tubercle on the hinder border, and with transversely oval and very slightly concave posterior face; the anterior facets for the atlas are relatively larger than in the Pleistocene genera and differ in shape and position, projecting much farther below the centrum and rising less upon the sides of the neural canal. The odontoid process is relatively longer, more slender and pointed than in *Mylodon*, less so than in *Megalonyx*, while the neural canal is larger than in any of the Pleistocene genera and the arch wider; the neural spine is broken away, but was evidently thin. The transverse processes are quite short and slender, more so than those of *Megalonyx*, which otherwise they resemble; the vertebrarterial canal is also as in this genus.

The other cervical vertebræ are much damaged and the sixth and seventh have been lost. The third vertebra is considerably smaller than the axis; the centrum is depressed and oblique, with transversely oval faces, is slightly opisthocœlous and has a well-defined ventral keel. The pedicles of the neural arch are low, but the arch itself is broad and is flattened on the dorsal side; the zygapophyses are large, especially the anterior pair. The spine and transverse processes are missing.

The fourth cervical is like the third, but it is somewhat smaller and has a less prominent keel; the transverse process is a slender rod, extended in the fore-and-aft direction and perforated at the base. The fifth is slightly smaller than the fourth.

Though several thoracic vertebræ have been lost from this skeleton, other species of the same genus indicate that the number was twenty-one or twenty-two. In the anterior part of the thorax the vertebræ have small centra, very broad neural arches and short, heavy spines, which incline backward, are thickened and rugose at the free ends, and so broad that hardly any intervals appear between the successive spines. The contrast in length between these short spines and the elongate processes of the great Pampean genera is very striking. Posteriorly, the centra become larger, especially in width, and on the ventral side of the penultimate thoracic are two small foramina, which on the last one become large and conspicuous; the transverse processes gradually shorten and have a more elevated position, arising from the neural arch rather than the centrum; the neural spines are somewhat shorter and less inclined, but broader and thicker. The accessory articular processes are not very well preserved, but seem to agree perfectly with those of other species of *Hapalops* and to consist of only one additional pair each of pre- and of post-zygapophyses.

In this individual are three lumbar vertebræ, which closely resemble the last two or three thoracics, but are larger; the centra are very broad and depressed, increasing in width posteriorly. The ventral foramina are very conspicuous, though this was a rather aged animal, with epiphyses united to the centra. The neural spines are broad and much thickened at the tip, but short and nearly erect; the transverse processes are rather short, but very broad, depressed, plate-like and curved forward.

Apparently the sacrum consists of six vertebræ, of which the first may be a lumbar, for its centrum is still separate from the others, though the spine is fused with the common ridge. In the middle part of the sacrum the centra become very thin and depressed, increasing again in thickness posteriorly. The ilia articulate with the first three, or perhaps, four vertebræ and the ischia with the last two.

Of the caudal vertebræ, nine are preserved, the first four in their natural position. Evidently, the tail was very stout, but not very long, and the number of vertebræ was probably not much more or less than twenty. The first caudal is large and massive and might easily be mistaken for the lumbar of a smaller animal; the centrum is short, broad and somewhat depressed, with transversely oval, nearly plane faces, and on the ventral side two parallel ridges, which bear facets for the first chevron-bone; the neural arch and canal are low and wide and the spine is heavy and quite prominent; the zygapophyses, especially the anterior pair, are very large, projecting in front of and behind the centrum, while the metapophyses are low and rugose; the transverse processes are long, broad and quite thick. The second, third and fourth caudals resemble the first and their centra are of nearly the same length, but grow narrower and thinner posteriorly, while the facets for the chevron-bones are more prominent, enclosing a deeper groove, and all the other processes are reduced. The third vertebra closely resembles the anterior caudal of *Nothrotherium* figured by Reinhardt ('78, Tab. II, figs. 4, 5).

Next, after an interval, follows a group of four vertebræ, which may be provisionally called the seventh, eighth, ninth and tenth. In these the centra have become cylindrical and the chevron-facets are even more prominent; these facets are no longer continuous ridges, but are separated by deep notches into anterior and posterior portions; from the notch on each side a well-defined groove passes up to the hinder border of the transverse processes; the latter are short, but quite broad; the neural canal is very small, especially on the ninth (?), which has no spine.

Lastly, there is an isolated vertebra, probably the twelfth or thirteenth caudal, in which the neural canal is hardly more than a pin-hole, the chevron-facets are much less prominent and the grooves almost obsolete.

The only chevron-bone preserved is that attached to the first and second caudals; this is short and Y-shaped, broad antero-posteriorly and thickened to form the vertebral facets; the distal, undivided portion is short and narrow, ending in a tubercle.

MEASUREMENTS.

Atlas, antero-posterior length	.031
" width	.078
" height, dorso-ventral	.032
Axis, length of centrum	.034
" width of anterior face	.035
" " " posterior face	.028
Third cervical, length of centrum	.024
" " width of anterior face	.022
" " " " posterior face	.020
Fourth cervical, length of centrum	.025
" " width of anterior face	.020
" " " " posterior face	.019
Anterior thoracic, length of centrum	.023
" " width of anterior face	.017
" " " " posterior face	.020
Anterior thoracic, width over transverse processes	.067
Anterior thoracic, height of neural spine above centrum	.046
Anterior thoracic, width of neural spine at tip	.020
First lumbar, length of centrum	.032
" " width of anterior face	.037

First lumbar, width over transverse processes	.075
First lumbar, height of neural spine	.036
First lumbar, width of neural spine at tip	.030
Third lumbar, length	.030
" " width of anterior face	.039
Sacrum, length	? 185
Sacrum, width of anterior face of centrum	.045
" " " posterior face	.030
First caudal, length of centrum	.026
" " width of anterior face	.034
First caudal, width over transverse processes	.115
Second caudal, length of centrum	.025
" " width of anterior face	.032
Second caudal, width over transverse processes	.084
Third caudal, length of centrum	.024
Third caudal, width of anterior face	.027
Third caudal, width over transverse processes	.085
Fourth caudal, length	.025
" " width of anterior face	.030
Fourth caudual, width over transverse processes	.082
? Seventh caudal, length	.024
" " width of anterior face	.024
? Seventh caudal, width over transverse processes	.062
? Eighth caudal, length	.024
" " width of anterior face	.020
? Ninth caudal, length	.023
? Eleventh caudal, length	.020
" " width of anterior face	.020
? Eleventh caudal, width over transverse processes	.048
? Thirteenth caudal, length	.020

Compared with those of the other species of the genus, the ribs of *H. longiceps* are decidedly broader and heavier, though they are much more slender than those of the great Pleistocene genera. The vertebral ribs are long and quite strongly curved, forming a capacious thorax. The head of each rib is rather broad, much depressed dorso-ventrally; the neck is elongate especially in the middle region of the thorax, and the tubercle is large, but flat and nearly sessile. A remnant of the tubercle is present on the penultimate rib, but not on the last one, which is very much shorter and more slender than the former. The sternal ribs are fully ossified, but their state of preservation is such that little can be determined concerning their shape and number.

Of the sternum nothing remains.

Appendicular Skeleton. — Only the distal portion of the scapula is preserved and in a much damaged condition; apparently there were no important differences from that of the other species.

The slender, elongate humerus (Plate XXX, figs. 2, 2*a*) is markedly similar to that of *Megalonyx* and *Nothrotherium*. The head is small and hemispherical and is set upon a rather more distinct neck than in the former; the tuberosities are better developed than in either of the genera named, especially the external one, which gives the bicipital groove a position on the inner side of the head, instead of opposite its middle. In the length and slenderness of the shaft there is a close resemblance to *Megalonyx*, but a likeness to *Mylodon* is seen in the great development of the deltoid ridge, which is far larger than in the former, but in spite of this great development, the "musculo-spiral course" is even less distinct than in *Megalonyx* (Leidy, '55, Pl. IX, fig. 2); the pectoral ridge is not conspicuous. For most of its length the shaft is irregularly cylindrical, and is greatly broadened and antero-posteriorly compressed distally, though relatively less so than in *Megalonyx*, while the very prominent and massive internal epicondyle is larger and the external smaller than in the latter, and the bony bridge over the epicondylar foramen is broader. The trochlea is wider than in the last-named genus, with much larger, spheroidal radial facet and slightly concave ulnar surface. The anconeal fossa is small and shallow, as in *Mylodon;* in *Megalonyx* it is obsolete.

In their proportions and general appearance the forearm bones most resemble those of *Megalonyx*, though having a certain resemblance to those of *Megatherium;* the extremely short and massive bones of *Mylodon* are entirely different. The ulna (Plate XXXII, fig. 4) is moderately elongate and has a short olecranon, which, however, is relatively longer than in *Megalonyx* or *Nothrotherium;* in shape it most resembles the olecranon of the former genus, but has no such transverse broadening of the proximal end; the coronoid process is more prominent and the sigmoid notch more nearly approximates the arc of a circle in form; the humeral facet is narrow and its internal division is much more produced distally than in the two Pleistocene genera; the facet for the head of the radius is small and nearly plane. The shaft is short, laterally compressed, and somewhat curved; the outer surface is deeply grooved, while the inner has only a shallow channel near the proximal end; the distal end is contracted and bears a small, oblique facet for the pyramidal.

The radius (Plate XXXII, fig. 3) is shaped much as in *Megatherium*, but with more decided antero-posterior and lateral curvature, and the more oval and projecting head gives it a less abruptly truncated appearance; the humeral facet is quite deeply concave and the proximal surface for the ulna is very narrow transversely and confined to the posterior side of the head. The shaft is strongly curved and has a convex anterior and concave posterior surface; its proximal portion is of transversely oval section, the breadth not greatly exceeding the thickness; below this the shaft broadens abruptly, the internal border becoming a thin edge, and continues to widen to the distal end; the ulnar border describes a regular, slightly concave curve, beginning below the bicipital tubercle, which is large, prominent and rugose, placed well below the head and on the posterior side of the shaft. The distal end of the radius is moderately wide and thick and has a large, low tuberosity on the dorsal face; the carpal surface is concave, undivided and oblique to the shaft, descending to the styloid process.

The manus (Plate XXXIII, fig. 2) is much less specialized than in any of the known Pleistocene genera, most resembling that of *Megalonyx*. All of the carpal elements are separate from one another. The scaphoid is very short proximo-distally, but very broad; on the ulnar border it is thick, but contracts much to the radial side, where it is extended into a blunt, hook-like and slightly recurved process; the radial facet is reflected far over upon the dorsal face, extending to and making a sharp angle with the surface for the trapezoid; on the distal end are large facets for the trapezium and trapezoid and, on the palmar side, one for the lunar also; contact with the magnum is extremely limited, while in *Megalonyx* it is quite extensive.

The lunar is large and shaped quite as in *Nothrotherium*, but with the radial facet much more extended upon the dorsal side. On the palmar side the lunar extends beneath the scaphoid and on the ulnar side has a very large, deeply concave facet for the pyramidal; distally, the lunar rests entirely upon the magnum and has no contact with the unciform.

The pyramidal is large and of irregularly cubical shape; it is longer proximo-distally than the scaphoid or lunar, but diminishes toward the ulnar border; the ulnar facet is large, somewhat saddle-shaped and forms almost a right angle with the surface for the pisiform, which is entirely palmar; on the radial side the pyramidal extends beneath the lunar, much as in *Megalonyx*.

The pisiform is large and laterally compressed, and somewhat resembles that of *Megalonyx*, but is of more nearly circular form.

As in *Nothrotherium*, the trapezium is free, while in the other Pleistocene genera it is fused with the scaphoid; it is long, very narrow and thick, and distally articulates only with metacarpal II. When placed in its natural position, the obliquity of the trapezium is such as to suggest that the pollex diverged considerably from the other digits.

The trapezoid is shorter than the trapezium, but otherwise quite large, and on the dorsal side is broad, contracting to a blunt edge on the palmar; the proximal end articulates with the scaphoid by a saddle-shaped facet, while the distal end is modelled to fit the curiously complex end of metacarpal II.

The magnum is rather small and narrow and but slightly longer than the trapezoid; proximally it is covered by the lunar, but the thin and elevated radial border is wedged in between the lunar and the scaphoid; distally the magnum articulates only with metacarpal III.

The unciform is large; on the dorsal side it is both broad and long, but on the palmar side contracts to a blunt point, though without forming a distinct palmar hook; the contact with the lunar, if present, must be very small and entirely lateral; the distal end articulates with metacarpal III, which notches it in a curious way, and with metacarpals IV and V, the facet for the latter rising on the ulnar side almost to the proximal end.

The metacarpus consists of five members, which are straight and have no such appearance of torsion as those of the Pleistocene Gravigrada and the recent ant-bear, the manus having the appearance of a plantigrade unguiculate.

Metacarpal I has been lost from this specimen, but in other species of *Hapalops* it has much the shape and relative size of that of *Nothrotherium.*

Metacarpal II is proportionately shorter and heavier than in the latter, longer and more slender than in *Megalonyx;* the proximal end, which is slightly wider than the shaft, has a large facet on each side for the adjoining metacarpals, but is connected only with the trapezoid, the facet for which is very complex, forming a deep groove on the radial and a plane surface on the ulnar side; the shaft is short, stout, slightly curved and of irregularly quadrate section, broadening and thickening slightly to the distal end; the carina is exceedingly prominent and the rest of the trochlea consists of a narrow surface on each side of it.

Metacarpal III has much the same shape as in *Megalonyx*, while in *Nothrotherium* it is longer and much more slender; the proximal end is very broad and has five different facets, for metacarpal II, the magnum, two for the unciform and one for metacarpal IV; the magnum surface is a narrow groove; the shaft is short and stout, much broader than any of the other metacarpals, and in its proportions is intermediate between metacarpal III of *Megalonyx* and that of *Nothrotherium*, longer and more slender than in the former, shorter and heavier than in the latter; the distal end bears a narrow trochlea, with immensely developed keel.

Metacarpal IV is the longest of the series and relatively much longer than in any of the Pleistocene genera, except *Nothrotherium*, in which it is even more elongate; the proximal end is moderately expanded transversely and palmo-dorsally, with facets for the unciform and for metacarpals III and V; the shaft is laterally compressed and slender, of quadrate section, but with convex dorsal surface, not flat or concave as in metacarpals II and III, with straighter lateral borders than in *Megalonyx* and without any such dorsal ridge; the distal end also is narrower than in the latter.

Metacarpal V also resembles that of *Megalonyx*, but is relatively longer and lighter; in length it is inferior only to metacarpal IV and is more slender than any other, with the probable exception of metacarpal I; the projection from the ulnar side of the proximal end is far less prominent and massive than in *Megalonyx;* the proximal end articulates with the unciform by a facet which is oblique and almost lateral, but does not reach the pyramidal; the shaft is very slender and somewhat curved, with decidedly concave ulnar border, and is of subcircular section; the distal end is small and club-shaped.

The phalanges are of similar shape in all of the digits, but with certain modifications in each one; on the whole, they most resemble those of *Megalonyx*, while in *Nothrotherium* they are peculiarly differentiated.

The proximal phalanx is very short, though relatively longer than in the Pleistocene genera, the length slightly exceeding the width and being much surpassed by the dorso-palmar thickness. In shape this phalanx best agrees with that of *Megalonyx*, but its proximal end is relatively less thickened; the proximal and distal surfaces are much alike, each having a very deep median groove; in *Nothrotherium* these grooves notch the dorsal face much more deeply and are separated only by a narrow bridge of bone. This phalanx is largest in digit III, smallest in V, and slightly larger in II than in IV.

The second phalanx is very much longer and narrower than the first and has the proximal end much thicker palmo-dorsally than the distal, though the difference is rather less decided than in *Megalonyx*; the proximal trochlea has two concave facets, separated by a prominent median ridge, which on the dorsal side becomes a conspicuous beak; the distal trochlea is extensively reflected upon both dorsal and palmar faces and describes somewhat more than half a circle; it consists of two rounded ridges, with a median groove between them; on the dorsal side of the phalanx, above the distal trochlea, is a deep pit for the beak of the ungual. The second phalanx is of nearly the same length in digits II, III and IV, but is heaviest in III; in digit V it is much shorter and more slender and the distal trochlea is reduced.

The ungual phalanges, which differ only in size in the various digits, quite closely resemble those of *Megalonyx*, being very long, compressed, decurved and sharply pointed, with a shallow cleft at the tip; the bony hood at the base of the claw has much the same relative development as in the latter, and the subungual process is similar, but somewhat narrower, and is pierced by two vascular foramina; the proximal end is very deeply incised to form a trochlea for the second phalanx and the dorsal border is drawn out into a broad, blunt beak. In the pollex the ungual is less reduced than that of *Megalonyx*, and in the three median digits is very large, longest in III and somewhat shorter in II than in IV; in V it is much smaller.

In length, the three median digits much surpass the laterals I and V, and are of nearly equal lengths, the phalanges compensating for the differences in the metacarpals. Thus, the longest digit is III, which is due to the size of the ungual, while the larger ungual of II makes it nearly as long as IV despite its much shorter metacarpal. In order of length the digits are as follows: III, IV, II, V, I. In actual length there is hardly any difference between digits III and IV, but the position of the former with reference to the carpus makes it appear to be considerably longer.

MEASUREMENTS.

Scapula, breadth distal end over coracoid	.068
Scapula, anterior-posterior diameter of glenoid cavity	.032
Humerus, length from head	.192
" width of trochlea	.044
" " over epicondyle	.079
Ulna, length	.197
" " of olecranon	.035
" width at sigmoid notch	.028
Radius, length	.165
Radius, width of proximal end	.025
" " " distal end	.030
Carpus, length in median line	.030
" width	.059
Metacarpal II, length	.038
" " width of proximal end	.016
" " " " distal end	.013
Metacarpal III, length	.038
" " width of proximal end	.023
" " " " distal end	.016

Metacarpal IV, length	.049
" " width of proximal end	.013
" " " " distal end	.014
Metacarpal V, length	.043
" " width of proximal end	.011
" " " " distal end	.007
First phalanx, digit II, length	.016
" " " III, length	.017
First phalanx, digit III, width of proximal end	.016
First phalanx, digit III, thickness of proximal end	.020
First phalanx, digit IV, length	.015
First phalanx, digit IV, width of proximal end	.014
First phalanx, digit IV, thickness of proximal end	.021
First phalanx, digit V, length	.009
First phalanx, digit V, width of proximal end	.009
First phalanx, digit V, thickness of proximal end	.012
Second phalanx, digit II, length	.027
Second phalanx, digit II, width of proximal end	.012
Second phalanx, digit II, thickness of proximal end	.016
Second phalanx, digit III, length	.025
Second phalanx, digit III, width of proximal end	.015
Second phalanx, digit III, thickness of proximal end	.020

Second phalanx, digit IV, length	.0235
Second phalanx, digit IV, width of proximal end	.0115
Second phalanx, digit IV, thickness of proximal end	.017
Second phalanx, digit V, length	.013
Second phalanx, digit V, width of proximal end	.008
Second phalanx, digit V, thickness of proximal end	.010
Ungual, digit I, length	.032
" " " width of proximal end	.010
Ungual, digit I, thickness of proximal end	.012
Ungual, digit II, length	.050
" " " width of proximal end	.012
Ungual, digit II, thickness of proximal end	.017
Ungual, digit III, length	.057
" " " width of proximal end	.014
Ungual, digit III, thickness of proximal end	.020
Ungual, digit IV, length	.047
" " " width of proximal end	.011
Ungual, digit IV, thickness of proximal end	.019
Digit I, length (approx)	.060
" II, "	.104
" III, "	.112
" IV, "	.110
" V, " (approx.)	.080

The pelvis differs notably from that of the large Pleistocene genera and has a certain resemblance to that of *Bradypus;* most of its length and width are made up of the ilia, the ischia being much smaller. The ilium has a broad, depressed and very short peduncle, the sacral surface extending back almost to the level of the acetabulum; anteriorly the ilium reaches considerably beyond the sacrum and partially conceals the second lumbar vertebra, when viewed from the side; the anterior plate is broad and flat, with acetabular border external, making the gluteal surface dorsal and the iliac surface ventral, even more strictly so than in *Bradypus;* the acetabular border describes a considerable curve, with the concavity turned outward; the gluteal surface is moderately concave and the iliac crest somewhat thickened and rugose. In the huge Gravigrada of the Pleistocene the ilia are immensely expanded and everted, making the gluteal surface posterior rather than dorsal and the iliac surface anterior rather than ventral, while the crista is enormously thick. However, the difference from the Santa Cruz type of pelvis, obvious as it is, is not at all fundamental, for the great expansion and eversion of the ilia occur in many unrelated groups of very large terrestrial mammals, such as the elephants, the titanotheres, etc., and the change in the form of the pelvis from the Santa Cruz to the Pleistocene ground-sloths is strictly analogous to that between *Palæosyops* and *Titanotherium.*

The ischium is much shorter than the ilium, but the disproportion is not so great as in *Bradypus;* it is depressed and broad, especially behind, where it is ankylosed with the transverse processes of the last two sacral vertebræ; the sacro-sciatic foramen is quite small, but relatively larger than in *Mylodon,* and the tuberosity is larger and more prominent than in the latter. The pubis is slender and laterally compressed, expanding somewhat at the distal end, where it forms a short symphysis; it is relatively much shorter than in *Mylodon* and the pelvic opening is consequently smaller, especially in the dorso-ventral diameter; the obturator foramen has approximately the shape of an equilateral triangle. The acetabulum presents directly outward and is of elongate oval shape; the articular surface is quite narrow, because of the very large sulcus for the round ligament.

MEASUREMENTS.

Pelvis, length	.262	Ilium, greatest width	.108
" greatest width	.340	Ischium, length	.101
Ilium, length	.161	Acetabulum, antero-posterior diameter	.050

The femur (Plate XXXII, fig. 5) resembles that of *Nothrotherium* in its proportions. The head is small and set upon a distinct neck and it presents more directly inward, less upward than in *Megalonyx,* and rises very little above the great trochanter; the pit for the round ligament is a shallow, pyriform depression and is entirely enclosed in the articular surface. The great trochanter is a heavy, rugged mass, which rises higher proximally than in the Pleistocene genera; the digital fossa is very small, but not so much reduced as in *Megalonyx;* the second trochanter is more prominent than in the latter, but less rugose and less extended distally, while the third trochanter is much larger and more prominent than in *Megalonyx* or *Nothrotherium*, the only Pleistocene genera in which this process is retained. The shaft is intermediate in character between the two genera named, being somewhat broader and more flattened than in the latter, less so than in the former; it is also relatively longer than in *Megalonyx*, considerably exceeding the humerus in length, while in the Pleistocene genus the two bones are nearly equal; the anterior or dorsal face of the shaft is slightly convex and its proximal half bears two long, parallel ridges for muscular attachment, which are less prominent than in the last-named genus. The tuberosities are prominent, and the external one is large and rugged, while the inner one is quite small. The rotular groove is somewhat narrower than in *Megalonyx* and is extended much farther upon the dorsal face of the shaft, with its proximal end distinctly projecting from the shaft, which has an obscurely marked suprapatellar fossa. The condyles are small and present so directly backward as to be concealed when the femur is viewed from the front; the inner condyle is considerably the larger of the two, being more prominent and more convex, while the outer one is slightly concave transversely; the intercondylar notch is narrower than in *Nothrotherium*. On the proximal side of each condyle is a small facet for the flabellæ, which are large, irregular nodules of bone.

The patella (Plate XXXII, fig. 6, 6*a*) is most like that of *Megalonyx*, a broad, shield-shaped bone, covered on the dorsal side with irregular longitudinal ridges, which give it a wrinkled appearance; its distal portion is more prolonged and ends in a much sharper point, while the articular surface for the rotular groove, which is very slightly convex, has a relatively greater proximo-distal extension.

In its proportions the tibia (Plate XXXIII, fig. 3, 3*a*) is intermediate between that of *Nothrotherium* and that of *Megalonyx;* it is considerably shorter than the femur, and in relation to that bone is somewhat shorter than in the former genus, longer and with narrower, less antero-posteriorly compressed proximal end than in the latter; the facets for the femoral condyles are separated only by a narrow sulcus and the inner one is larger and more concave and stands at a lower level than the outer, which is convex and produced farther behind the plane of the shaft, though it has no such extension as in *Megalonyx*, and the fibular facet is a longer, narrower oval. The shaft is relatively longer, narrower and thicker than in the last-named genus and its fibular border is far less concave; the proximal portion of the shaft is subtrihedral and the distal part is broad and antero-posteriorly compressed, but for most of its length is of irregularly oval section; the cnemial process is very inconspicuous. The distal end is much like that of *Nothrotherium*, but the conspicuous process, grooved by a tendinal sulcus, which projects from the inner side (see Plate XXXIII, fig. 3*a*), is more prominent than in that genus or in *Megalonyx*, and the inner malleolus is less reduced than in the latter. The astragalar surface has two shallow facets divided by a low intercondylar ridge, which, on the dorsal border becomes a tongue-like process; the external astragalar facet is continuous with that for the distal end of the fibula; the latter surface presents distally rather than laterally, as is also true of both the Pleistocene genera.

The fibula (Plate XXXIII, fig. 3, 3*a*), though short and stout, is relatively much longer and more slender proportionally than in *Mylodon;* the proximal end is thick and club-like and bears an elongate, narrow facet for the tibia; the shaft is irregularly cylindrical and the distal end much enlarged and very massive.

MEASUREMENTS.

Femur, length from head	.212	Tibia, width of shaft in middle	.021
" " " great trochanter	.218	" thickness of shaft in middle	.028
" width of proximal end	.084	" width of distal end	.055
Femur, width of distal end over tuberosities	.076	" thickness of distal end	.028
Femur, width of rotular groove	.026	Fibula, length	.155
" " over condyles	.066	" width of proximal end	.020
Patella, length	.041	" thickness of proximal end	.029
" width	.037	" width of shaft in middle	.010
Tibia, length	.163	" thickness of shaft in middle	.014
" width of proximal end[1]	.062	" width of distal end	.023
" thickness of proximal end	.057	" thickness of distal end	.030

The pes (Plate XXXII, fig. 4) belongs to the type of *Megalonyx* and *Nothrotherium*, both of which it resembles. The astragalus is much like that of the former genus, but somewhat longer and narrower; the trochlea is much more deeply grooved and is quite distinctly divided into inner and outer condyles, of which the internal one is much larger both in the proximo-distal and dorso-plantar diameters; at the distal end the trochlea is invaded by a narrow V-shaped sulcus, which ends in a deep pit on the neck for the reception of the tongue-like process of the tibia; the fibular facet is large and crescentic, as in *Megalonyx*, but with much more concave plantar border, narrower proximal portion and much less prominent everted process at the distal end. The external calcaneal facet is somewhat narrower than in *Megalonyx*, but much more concave and more oblique to the proximo-distal axis, while the facet for the sustentaculum is less distal and more internal in position and is separated from the outer facet by a narrower sulcus. The neck is much shorter than in *Nothrotherium* and even somewhat shorter than in *Megalonyx*, but has a navicular facet like that of the latter, concave at the distal end and reflected well over upon the tibial side. An important difference from the last-named genus is in the position of the cuboid facet, which is a convexity on the plantar side of the neck, while in the Pleistocene genus it is on the fibular side. In the astragalus of *Nothrotherium* the most striking difference from that of *Hapalops* is the much longer neck, which is constricted by a deep notch on each side, ending in a convex head.

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[1] Reduced by lateral crushing.

The calcaneum also resembles that of *Megalonyx*, which Leidy describes as "having very much the appearance of the os ilium of some smaller animal" ('55, 41). The tuber is long, but much less elongate and with a far less slender neck than in the two Pleistocene genera, expanding much more abruptly into a very broad, depressed, falcate plate, which has a longer tibial than fibular border, while the proximal border is much thickened and rugose, with prominent tubercles on the plantar side; the distal end is very heavy, with a great prominence on the fibular side. A number of differences from the calcaneum of *Nothrotherium* may be observed in the distal portion; the external astragalar facet is smaller, more simply convex and less reflected upon the dorsal side; the sustentaculum is smaller and its facet is smaller and more distal, less dorsal; the cuboid surface is more oval.

The navicular quite closely resembles that of *Megalonyx*, but is more nearly circular and the low convexity on the proximal face, which fits into the distal end of the astragalus, is less prominent; on the tibial side the border is much raised, so that the proximo-distal length on this side is more than twice as great as on the fibular; the large, convex facets for the meso- and ectocuneiforms are more closely approximated than in the Pleistocene genus, while that for the entocuneiform is entirely lateral.

The entocuneiform has been lost from the specimen.

The mesocuneiform is broad and extremely short proximo-distally, and is much less extended in the dorso-plantar dimension than the ectocuneiform. The latter is quite large, especially on the dorsal side, tapering to a blunt point on the plantar; the distal end is wedge-shaped and fits into the deep groove on the head of metatarsal III.

The cuboid is rather small, relatively narrower and more pyramidal than in *Megalonyx*, and is so placed in the tarsus that its long axis is oblique to that of the calcaneum and astragalus, and it lies partially upon the plantar side of the neck of the astragalus, to which it affords considerable support. The calcaneal facet forms a prominent convexity on the fibular side and that for the astragalus is large, slightly concave and dorsal in position, the two surfaces meeting at the proximal end, to which they give a wedge-like shape. Distally, the facet for metatarsal IV is very large and that for V is very narrow, much narrower than in *Megalonyx*.

A large plantar sesamoid is preserved in connection with this pes; it is flattened and scale-like, but quite thick and heavy and of an irregularly pentagonal shape with rounded angles, and its principal diameter is transverse. This sesamoid is placed upon the plantar side of the cuneiforms, extending under metatarsals I and II.

The five metatarsals are strikingly like those of *Megalonyx* and *Nothrotherium*, with somewhat closer resemblance to the latter. As in both of the genera named, the three inner members (I–III) are very short and the two outer ones (IV, V) much longer.

Metatarsal I is short and slender, far more so than in *Nothrotherium*, in which this bone is very stout; the facet for the entocuneiform is large and saddle-shaped, the shaft very short and subcylindrical and the distal carina very low.

Metatarsal II is much larger in all its dimensions than I and is relatively shorter and heavier than in *Nothrotherium*, much more slender than in *Megalonyx;* the broad proximal end has a transversely concave surface for the mesocuneiform; the shaft is very heavy and the distal trochlea is very large with heavy, prominent carina.

Metatarsal III is much the most massive of the series and, except I, the shortest; its length slightly exceeds the breadth, while in both of the Pleistocene genera the breadth exceeds the length; the two sides of the facet for the ectocuneiform meet at an obtuse angle and on the fibular side of the head is a very large plane surface for the fourth metatarsal; the broad distal trochlea has a very prominent and thick carina, which, however, does not attain such proportions as in *Megalonyx*.

Metatarsal IV is in very striking contrast to III, being more than twice as long and very much more slender; it is relatively longer, straighter and of more regular shape than in *Megalonyx* and has more nearly the proportions of *Nothrotherium;* the proximal end is narrow and of great dorso-plantar thickness and bears an oblique facet for the cuboid, and extensive lateral facets for the adjacent metatarsals, and the relative position of these three facets is such that the bone is given a strongly divergent direction, as in *Nothrotherium;* the shaft is relatively slender and elongate, almost straight and of subquadrate section with rounded angles; the trochlea is narrow, not much wider than the shaft, but very thick and with very prominent carina.

Metatarsal V has much the same characteristics as in *Nothrotherium* and *Megalonyx;* the cuboid facet is very much narrower than in those genera, especially the latter; the shaft is depressed and shorter than that of IV and gives off from the fibular side near the proximal end a very large, triangular process, which is unfortunately broken, but was doubtless shaped as in other species of *Hapalops* and very similar to that of *Nothrotherium;* the distal trochlea is quite different from that of II, III and IV, being merely an elliptical convexity, without carina.

The phalanges are very much like those of the manus, but considerably shorter, and those of digits II and III are much heavier. The first phalanx of the hallux is relatively long, laterally compressed and slender; its proximal trochlea is deeply concave and but feebly grooved for the carina; near the distal end is a deep dorsal pit to receive the beak of the ungual. In digit II the first phalanx is short, wide and very thick, especially at the proximal end, and both trochleæ are very deeply grooved in the median line, while in digit IV it is of nearly the same size as in II. All the phalanges of the fifth digit have been lost.

The second phalanx is like that of the manus in form, but in digits II and III, at least, it is very much heavier. In the second digit this phalanx is moderately elongate, though attaining no such length as it has in *Nothrotherium*, and in the third it is very short and extremely heavy.

The ungual phalanx of the hallux is considerably shorter than that of the pollex, but broader and thicker. Digit II has a very much larger ungual, which is shorter and more massive and is more strongly decurved than the corresponding claw in the manus, and the distal cleft is more extended along the dorsal border. The third digit has a still longer and heavier ungual, the proximal end of which is extremely massive; owing chiefly to the size of this ungual, digit III is considerably longer than II, though the difference is decidedly less than in *Nothrotherium*.

As a whole, the pes is considerably larger than the manus, especially exceeding the latter in the massiveness of its component parts.

Measurements.

Calcaneum, length	.075
" width of proximal end	.065
" " " distal end	.038
Astragalus, length	.042
" width of trochlea	.029
" " " distal end	.023
" thickness of distal end	.016
Navicular, length on tibial side	.016
" " " fibular side	.005
" width	.026
Metatarsal I, length	.020
" " proximal width	.010
" " distal width	.008
Metatarsal II, length	.025
" " proximal width	.017
" " " thickness	.016
" " distal width	.015
" " " thickness	.020
Metatarsal III, length	.026
" " proximal width	.023
" " " thickness	.027
" " distal width	.017
" " " thickness	.023
Metatarsal IV, length	.055
" " proximal width	.014
" " " thickness	.025
" " distal width	.014
" " " thickness	.023
Metatarsal V, length	.045
" " proximal width	?.027
" " " thickness	.017
Metatarsal V, distal width	.013
" " " thickness	.014
First phalanx, digit I, length	.019
" " " " proximal width	.010
" " " " " thickness	.0135
" " " " distal thickness	.0085
First phalanx, digit II, length	.016
" " " " proximal width	.013
" " " " proximal thickness	.019
" " " " distal thickness	.013
" " " III, length	.019
" " " " proximal width	.017
" " " " proximal thickness	.028
" " " " distal thickness	.017
" " " IV, length	.016
" " " " proximal width	.012
" " " " proximal thickness	.022
" " " " distal thickness	.015
Second phalanx, digit II, length	.026
" " " " proximal width	.013
" " " " proximal thickness	.018
" " " " distal thickness	.012
" " " III, length	.022
" " " " proximal width	.018
" " " " proximal thickness	.024
" " " " distal thickness	.015

Ungual, digit I, length	.026	Ungual, digit III, length	.060
“ “ “ proximal width	.011	“ “ “ proximal width	.020
“ “ “ thickness	.015	“ “ “ “ thickness	.028
“ “ II, length	.049	Digit I, length	.057
“ “ “ proximal width	.013	“ II, “	.097
“ “ “ “ thickness	.018	“ III, “	.102

Restoration (Plate XXX). As there is no available material for a restoration of *Megalonyx* or *Nothrotherium*, Owen's well-known figure of *Mylodon* ('42, Pl. I) has been selected as a standard of comparison and the skeleton of *H. longiceps* has been drawn in a similar attitude. Between the Santa Cruz and the Pampean genus the contrasts are much more numerous and striking than the resemblances. In the former the head is relatively small, with elongate rostrum, slender, rod-like premaxillaries and long, pointed mandibular beak; the neck is long and light, and the trunk, especially the thoracic region, is extraordinarily elongate, a very marked difference from the rather short and extremely bulky trunk of *Mylodon;* the neural spines of all the trunk-vertebræ are far shorter than in the latter; the tail, though heavy, is not nearly so massive. The pelvis has a very different appearance, owing to the much less extreme expansion, eversion and rotation of the ilia and to the shorter pubes and descending processes of the ischia. The limbs are far more slender than in *Mylodon*, the feet pentadactyl and very little modified, all the digits being functional and provided with claws; although the manus may have already acquired, in an incipient degree, the rotation which brought the ulnar border to rest upon the ground in walking, it is probable that the pes was simply plantigrade.

On the other hand, this skeleton has a number of suggestive resemblances to that of the recent Tardigrada. In making such a comparison, it should be remembered that the latter are extremely specialized and adapted to a very unusual mode of life; the whole skeleton is modified in accordance with the habit of *suspending* the weight of the body and the feet are transformed into mere hooks. In spite of such mechanical differences between the strictly arboreal Tardigrada and the doubtless as strictly terrestrial Gravigrada, there is much to suggest a common origin of the two groups, and these correspondences are particularly clear in the skeleton before us. The type of skull and dentition is essentially the same, and the extremely elongated trunk is very like that of *Cholœpus;* the tail is, of course, very different, but this is sufficiently accounted for by the radically different manner of life. Scapula and pelvis are very similar in the two groups, and even the limb-bones, notwithstanding their very striking differences of proportions, have many features in common. Even the feet, unlike as they at first appear, are yet so fundamentally similar as to offer no difficulty to the assumption that the two groups were derived from the same ancestral stock.

HAPALOPS RECTANGULARIS Ameghino.

(Plate XL, Figs. 1, 1ª.)

Hapalops rectangularis Amegh.; Enumeracion sistematica, etc., 1887, p. 22.
Hapalops ellipticus Amegh.; Ibid.
Schismotherium rectangularis Mercerat; Rev. del. Mus. de La Plata, T. II. 1891, p. 9.
Eucholœops ingens Lydekker, in part; Anales del Mus. de La Plata, T. II, 1894, p. 99.

The type of this species, and therefore of the genus, is a small fragment of the left mandibular ramus, in the La Plata Museum. Unfortunately, this fragment is very uncharacteristic and might belong to any one of several species. In the collection made by Mr. Brown for the American Museum of Natural History is an excellently preserved mandible (No. 9222) with all of the teeth in place, which agrees very clearly with the corresponding portion of the type and is probably referable to the same species.

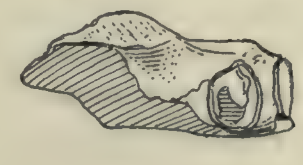

FIG. 29.
Type of *Hapalops rectangularis*, × 1/1.
La Plata Museum.

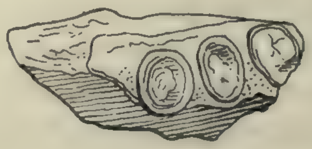

FIG. 30.
Type of *Hapalops ellipticus*, × 1/1.
La Plata Museum.

The first lower tooth is small, of compressed elliptical shape, with oblique abraded surface, which presents forward and outward; $\overline{2}$, which follows after a short diastema, is very broad and rectangular, with rounded angles; $\overline{3}$ is similar, but more distinctly quadrate, while $\overline{4}$ is of the usual, subcylindrical shape.

The edentulous beak of the mandible is short and the chin rises quite steeply, with a concave profile; the ascending ramus has a less sinuous ventral border than in *H. longiceps*, and the coronoid process, which is rather low and narrow, is more recurved, making a deeper sigmoid notch; the angle is broad and heavy, but not very long, and has the ventral border inflected, which makes the external side convex and the inner side concave. The postero-external opening of the dental canal is in the ascending ramus and presents so directly forward as to be nearly invisible in side view.

MEASUREMENTS.

Lower dentition, length	.036	$\overline{4}$ width	.0073
" " " $\overline{2}$-$\overline{4}$	.025	Mandible, length from condyle	.103
$\overline{1}$, length (*i. e.*, antero-posterior diameter)	.004	" " " angle	.109
" width (*i. e.*, transverse diameter)	.005	" " of predental beak	.025
$\overline{2}$, length	.0065	" depth below $\overline{3}$	.024
" width	.009	" thickness below $\overline{3}$	.013
$\overline{3}$, length	.0065	" length condyle to $\overline{4}$	.045
" width	.009	" height of coronoid	.047
$\overline{4}$, length	.0075	" " " condyle	.037

Associated with this mandible are a calcaneum and astragalus, so peculiar as to indicate the perfect distinctness of the species, provided, of course, that the association is not accidental. The astragalus has the narrow and elongate shape common throughout the family, but the trochlea has quite a different shape from that of the other species; its distal portion is relatively broader and the proximal part narrower, making the tibial border more oblique; the inner condyle is shorter proximo-distally, more elevated and convex, and with a much more distinct tendency toward the assumption of the odontoid form than in any other known species of the genus, or, indeed, of the family. The calcaneum has the form common to all the members of this genus, but is distinguished by the close approximation of the two astragalar facets, which are separated only by a very narrow sulcus, and by a slight reflection of the inner facet upon the dorsal side of the sustentaculum.

MEASUREMENTS.

Astragalus, length	.030	Calcaneum, length	.051
Astragalus, width of trochlea, proximal end	.016	" proximal width of tuber	.044
Astragalus, width of trochlea, distal end	.021	" width of tuber at neck	.015
" " " neck	.016	" " " distal end	.023

Hapalops indifferens Ameghino.

(Plate XXXIV, Figs. 1–5.)

Hapalops indifferens Amegh.; Enumeracion sistematica, etc., 1887, p. 22.
Hapalops (?) indifferens Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 13.
Eucholœops ingens Lydekker, in part; Anales del Mus. de La Plata, T. III, 1894, p. 99.

The type of this species, which is in the La Plata Museum, is an incomplete right mandibular ramus, with the first tooth broken to the level of the jaw and the other teeth missing. To this species may be referred an individual in the Princeton collection (No. 15,110), which agrees very well with what is preserved of the type, save in regard to the position of the mental foramen, which in the latter is remarkably far forward, but this is doubtless individual merely. The specimen consists of the anterior half of the skull, with mandible complete and all the teeth in place; one cervical, ten thoracic, two lumbar and one caudal vertebræ; the left ulna, lacking the distal epiphysis, and metacarpals II–IV of the left manus; the left femur and a considerable portion of both hind-feet.

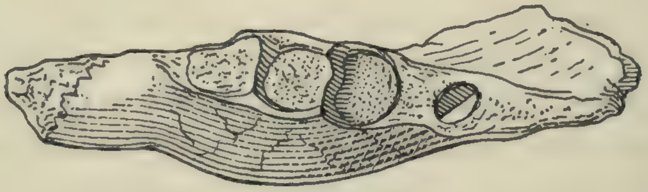

Fig. 31.
Type of *Hapalops indifferens*, × ½. La Plata Museum.

In the upper jaw $^{\underline{1}}$ is smaller than that of *H. longiceps* and of more oval section, and is implanted farther behind the maxillo-premaxillary suture; the remaining upper teeth differ little, save in size from those of the last named species; $^{\underline{3}}$ and $^{\underline{4}}$ are usually more rectangular, while $^{\underline{5}}$ has a more oblique position and has no vertical groove on the posterior face. In some individuals the outer side of $^{\underline{2}}$, $^{\underline{3}}$ and $^{\underline{4}}$ displays a vertical sulcus. Of the lower teeth $_{\overline{1}}$ is small, erect, of oval cross-section and is separated by a short distance from $_{\overline{2}}$; $_{\overline{2}}$ and $_{\overline{3}}$ are transverse and rectangular and $^{\underline{4}}$ is subcylindrical.

MEASUREMENTS.

Upper dentition, length	.050	$\underline{5}$, width	.007
" " " $\underline{2-5}$	.031	Lower dentition, length	.041
^{1}, length (*i.e.*, antero-posterior diameter)	.006	" " " $\overline{2-4}$	.027
" width (*i. e.*, transverse diameter)	.005	$\overline{1}$, length	.005
$\underline{2}$, length	.006	" width	.004
" width	.008	$\overline{2}$, length	.007
$\underline{3}$, length	.007	" width	.009
" width	.009	$\overline{3}$, length	.007
$\underline{4}$, length	.007	" width	.009
" width	.0085	$\overline{4}$, length	.009
$\underline{5}$, length	.0055	" width	.009

The skull varies considerably in its appearance and proportions; in the more typical examples the skull is long and slender, with comparatively narrow muzzle and palate; the postorbital constriction is shallower and more gradual than in *H. longiceps*, the forehead is narrower and the sagittal crest on the frontals is lower and thicker; the nasals are shorter in the median line, but each has a very elongate lateral process which accompanies the maxillary to the edge of the anterior nares. The preorbital fossa of the maxillary is quite shallow and the facial portion of that bone is continued to an unusual distance in front of $\underline{1}$ as a thin plate; the dorsal margin of this plate is strongly curved, making its vertical anterior edge very short dorso-ventrally. The premaxillaries, as is shown by a skull in the Ameghino collection, resemble those of *H. longiceps* in form, but are much less elongate, the difference being principally in the anterior branch, and the median notch in the palatine processes of the maxillaries for the spines of the premaxillæ is larger and more regularly U-shaped.

The mandible differs in only a few details from that of *H. longiceps;* the predental beak is shorter and its dorsal border is much more nearly horizontal and is lower with reference to the level of the teeth; the symphysis is shorter and the profile of the chin rises more steeply, though compared with most other species of the genus, the beak is very long. The condyle is set upon a shorter neck than in *H. longiceps* and is thicker and more convex; the coronoid process is lower, wider, more erect and less recurved, and the angular process is also shorter and wider and is less distinctly inflected. The postero-external opening of the dental canal is on the side of the ascending ramus. In the type-specimen the mental foramen has a much more anterior position than in the other mandibles referred to this species, but that is probably individual.

Measurements.

Skull, length from orbit to anterior nares	.031	Palate, width at $\underline{5}$	.012
“ width at postorbital constriction	.033	Mandible, length from condyle	.132
“ “ over lachrymals	.054	“ “ “ angle	.134
Rostrum, width at base	.026	“ “ of predental beak	.036
“ “ “ anterior end	.029	“ “ from condyle to $\overline{1}$	.059
Palate, length in median line	.054	“ height of coronoid	.059
“ width at $\underline{1}$	.026	“ “ “ condyle	.046
“ “ “ preorbital fossæ	.024	“ depth below $\overline{3}$	.027
“ “ “ $\underline{2}$	.014	“ thickness below $\overline{3}$	.016

Except for their smaller size, the vertebræ of the various regions are so like those of *H. longiceps* as to require no particular description.

The ulna likewise differs but little from that of the last named species; it is shorter and straighter and the shaft has a relatively greater transverse and smaller antero-posterior diameter, while the facet for the head of the radius is larger and more distinctly demarcated.

The metacarpals differ from those of *H. longiceps* only in size.

The femur, on the other hand, is quite different; the head is set upon a less constricted neck and presents more obliquely upward, less inward; the great trochanter is much lower, so that there is no notch between it and the head; the process, though low, is very heavy and encloses a small, but deep digital fossa; the second trochanter is much less prominent and more distal in position; the shaft is notably narrower and less antero-posteriorly compressed; the rotular groove is more concave and has more elevated borders, while the condyles display no noteworthy peculiarities.

The pes is represented by the calcaneum, navicular, mesocuneiform, metatarsal IV and several phalanges. The calcaneum is quite strikingly different from that of *H. longiceps;* the tuber is narrower, thicker, less depressed planto-dorsally and more strongly arched, with more concave plantar face; the proximal end is much less expanded and its internal angle is much more thickened; the process from the fibular side near the distal end is much less prominent and the two facets for the astragalus are farther apart. The other foot-bones require no description.

Measurements.

Ulna, estimated length	.176	Metacarpal II, distal width	.012
“ “ of olecranon	.030	Metacarpal III, length	.036
“ width at sigmoid notch	.028	“ “ proximal width	.019
Metacarpal II, length	.035	“ “ distal width	.015
“ “ proximal width	.012	Metacarpal IV, length	.044

Metacarpal IV, proximal width	.011	Calcaneum, distal width	.027
" " distal width	.012	" width at constriction	.020
Femur, length from head	.201	Navicular, length on tibial side	.013
" " " great trochanter	.196	" " " fibular side	.010
" proximal width	.071	" width	.024
" distal width over tuberosities	.062	Metatarsal IV, length	.049
" " " " condyles	.055	" " proximal width	.014
" width of rotular groove	.030	" " " thickness	.023
Calcaneum, length	.071	" " distal width	.013
" proximal width	.053	" " " thickness	.019

The specimen upon which the foregoing description is founded was collected by Mr. Hatcher at Corriken Aike on the coast of Patagonia.

HAPALOPS GRANDÆVUS Mercerat.

(Plate XLIII, Figs. 6, 6ᵃ.)

Hapalops grandævus Mercerat; Rev. del. Mus. de La Plata, T. II, 1891, p. 13.

This species is very close to *H. indifferens* and may indeed be referable to it, but the differences would appear to be quite constant. The following description is drawn chiefly from a well-preserved mandible in the American Museum of Natural History (No. 9538) which agrees quite closely with Mercerat's type in the La Plata Museum. The first lower tooth, which in *H. indifferens* is of the usual subcylindrical form, in the present species is markedly trihedral, with the base of the triangle directed inward and slightly backward and the apex outward and slightly forward, two vertical sulci, one on the outer side near the posterior border and the other on the inner side near the anterior border, give the tooth a characteristically fluted or columnated appearance.

The other teeth are like those of *H. indifferens;* $\overline{2}$ and $\overline{3}$ are transverse and rectangular, though a little broader on the internal and on the external side, and $\overline{4}$ is irregularly cylindrical and of curiously different shape on the two sides of the jaw.

The mandible differs from that of *H. indifferens* in a number of respects, the most obvious of which is the somewhat shorter predentary beak, which has a more flared and depressed dorsal border. The condyle is set upon a shorter neck, narrowing the notch between condyle and angle; the posterior border of the coronoid process is more curved, and the postero-external opening of the dental canal is smaller and has a more inferior position at the base of the ascending ramus.

MEASUREMENTS.

Lower dentition, length	.042	$_{\overline{4}}$, length	.008
" " " $_{\overline{24}}$	.0255	" width	.008
$_{\overline{1}}$, length (*i. e.*, antero-posterior diameter)	.0055	Mandible, length from condyle	.125
" width (*i. e.*, transverse diameter)	.005	" " of predentary beak	.032
$_{\overline{2}}$, length	.007	" " condyle to $_{\overline{4}}$	.055
" width	.009	" " depth at $_{\overline{3}}$	.029
$_{\overline{3}}$, length	.0075	" " thickness at $_{\overline{3}}$	.016
" width	.009	" height of condyle	.040

HAPALOPS ROBUSTUS Ameghino.

Hapalops robustus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 316.

Typical examples of this species seem very distinct, but the gradations are such that the propriety of separating it from *H. indifferens* is doubtful. It is not represented by well preserved specimens in the New York or the Princeton collection and I shall therefore quote Ameghino's diagnoses of it.

"Size a little greater than *H. indifferens*, but more robust; distinguished by the very broad palate, a little narrower in the middle than before or behind; $^{\underline{1}}$ small and cylindrical, $_{\overline{1}}$ subelliptical, with postero-external side very broad and antero-external very narrow. Length of upper dental series 53 mm., of lower 38 mm.; breadth of palate at $^{\underline{5}}$, 16 mm.; at $^{\underline{1}}$, 22 mm." ('91^{f}, 316).

"Size a little smaller than *H. indifferens* (it was erroneously stated to be a little larger in my description). The mandibular symphysis is shallow and very elongate; the part which extends in front of the first tooth is 35 mm. long. Length of skull from hinder edge of occipital condyles to the anterior border of the maxillary 170 mm. The maxillaries are prolonged in front of the first tooth more than in the other species (12 mm. on the palate)" (94^{a}, 145).

The distinguishing feature of the skull is its great breadth, especially in the facial region, and the depth of the preorbital fossæ, which are shallow and ill defined in *H. indifferens*. In both species the molariform teeth have similar rectangular shapes.

HAPALOPS AGUIRREI (Mercerat).

Tapinotherium aguirrei Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 17.

Hyperleptus sectus Amegh., in part; Énum. synopt. d. Mamm. Foss. de Patagonie, 1894, p. 152.

Eucholœops ingens Lydekker, in part; Anales del Mus. de La Plata, T. III, 1894, Pl. LIX, fig. 2.

The type specimen, a skull without mandible, which is in the collection of the La Plata Museum, is unfortunately much injured by crushing, which greatly obscures some of the more important diagnostic features. The species is of the type of *H. robustus*, to which it may prove to be referable, but it displays some peculiarities and certain suggestive approximations to *Encholœops*, so that, for the present at least, it is advisable to keep it distinct. The specimen has already been figured by Lydekker ('94, Pl. LIX, fig. 2), under the name *E. ingens*. *H. aguirrei* is one of the largest species of the genus, but in proportion to the size of the skull the teeth are strikingly small. The first upper tooth has the usual laterally compressed, oval section and is set much externally to the line of the other teeth, almost as much as in *Eucholœops*, and is separated from $^{\underline{2}}$ by a long diastema; $^{\underline{2}}$, $^{\underline{3}}$ and $^{\underline{4}}$ are of transversely oval shape and quite compressed antero-posteriorly; of these teeth $^{\underline{3}}$ is the largest and $^{\underline{4}}$ the smallest; $^{\underline{5}}$ is much the smallest of the entire molariform series and has a reniform masticating surface, convex in front and concave behind; the interspaces between the teeth are unusually long. Aside from $^{\underline{1}}$, the two series of upper teeth are nearly parallel and converge but little posteriorly.

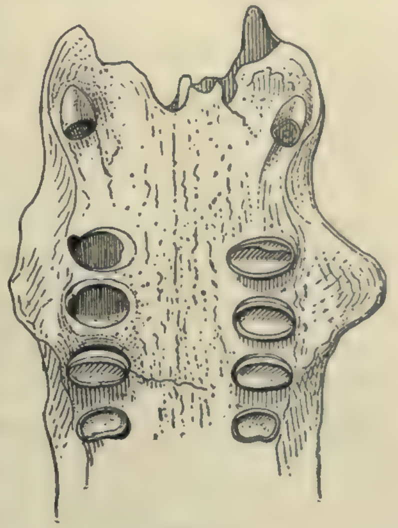

FIG. 31.

Type of *Hapalops* (*Tapinotherium*) *aguirrei*, × ⅘. La Plata Museum.

MEASUREMENTS.

Upper dentition, length	.063	$\underline{3}$, length	.008
" " " $\underline{2\ 5}$	.036	" width	.011
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.007	$\underline{4}$, length	.0065
" width (*i. e.*, transverse diameter)	.005	" width	.010
$\underline{2}$, length	.007	$\underline{5}$, length	.005
" width	.011	" width	.0073

The cranium is long and very broad and has but a feebly marked postorbital constriction; the extent to which the supraoccipital is reflected over upon the roof of the skull cannot be clearly determined, but it would appear to be much less than in most species of *Hapalops* and more as in *Eucholœops.* Another resemblance to the latter is to be found, apparently, in the greater distinctness of the occipital crest, though the skull is so damaged in this region that it is difficult to interpret. The rostrum is short and very broad and has deep preorbital fossæ, and the nasals are short and very broad. The palate is but moderately convex between the molariform teeth, less so than in most species of the present genus, and its anterior median notch for the premaxillary spines is a deep, very widely open V, which indicates that the premaxillæ had a distinctive shape.

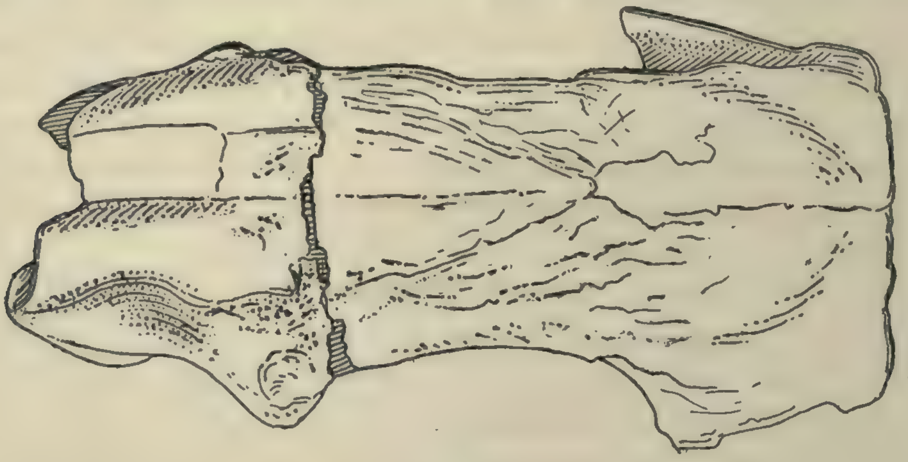

Fig. 32.

Type of *Hapalops* (*Tapinotherium*) *aguirrei*, × ¾. La Plata Museum.

MEASUREMENTS.

Skull, length in median basal line	.150	Rostrum, length (exclusive of premaxillæ)	.040
" extreme length	.186	Palate, length in median line	.059
" width at postorbital constriction	.049	" width at $\underline{1}$	.035
Rostrum, width at anterior end	.054	" " " $\underline{5}$	.020

HAPALOPS BRACHYCEPHALUS Ameghino.

(Plates XXXV, XXXVI.)

Hapalops brachycephalus Amegh.; Énum. Synopt. d. Mamm. Foss. de Patagonie, 1894, p. 146.

This appears to be a relatively well-defined species and to it are here referred a skull (No. 15,596) in the Princeton collection, which agrees closely with the type, and, somewhat doubtfully, another skull in the American Museum of Natural History (No. 9176), which differs in many respects and may perhaps be referable to another species; some of these differences are, however, evidently due to the immaturity of this individual.

In the type and in the Princeton specimen, $\underline{1}$ is very thin and much compressed laterally, quite elongate antero-posteriorly, while in the third specimen this tooth is of the usual oval form and is much less compressed and the diastema between $\underline{1}$ and $\underline{2}$ is considerably shorter. This tooth is inserted near the anterior end of the maxillary, even the facial plate of which extends but little in advance of it. The molariform teeth are, in the typical examples, relatively small, of transversely oval shape and antero-posteriorly compressed, while in No. 9176 these teeth are of a more rectangular shape (Plate XXXVI, fig. 4); $\underline{3}$ is the largest of the series and $\underline{5}$ is very small.

MEASUREMENTS.

	No. 9,176.	*No. 15,596.*
Upper dentition, length	.049	.054
" " " $\underline{2-5}$	.031	.030
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.006	.008
" width (*i. e.*, transverse diameter)	.005	.0045
$\underline{2}$, length	.007	.006
" width	.008	.009
$\underline{3}$, length	.007	.0065
" width	.009	.010
$\underline{4}$, length	.006	.006
" width	.0085	.0095
$\underline{5}$, length	.004	.005
" width	.007	.008

The skull is of the type of *H. robustus*, though on a distinctly smaller scale; it is short and depressed, but very broad; the parietal eminence rises very little above the occipital crest and the cranium is low and broad, contracting forward very gradually to the shallow postorbital constriction, whence the skull again expands forward in the same gradual manner to the very broad forehead and muzzle; the rostrum is constricted by the deep preorbital fossæ. The sagittal crest, at least in the adult, is better developed than in most species of *Hapalops*, but is never conspicuous, and in the young specimen referred to this species there is no crest, merely a broad, indistinct sagittal area. The occiput is nearly vertical and has a broad median convexity, which dorsally curves forward upon the roof of the cranium for a short distance and much farther in the immature skull; in the adult this extension is much less and the occipital crest is better developed than in most of the other species of this genus, but in the young animal the crest is very low and indistinct on the sides, and dorsally dies away altogether. Another difference between the young and the adult skull is in the median convexity of the occiput, which lodges the vermis of the cerebellum, and is much more prominent in the former than in the latter; the paroccipital processes are unusually well-defined. Only a narrow strip of the periotic is exposed upon the surface of the skull and there is no fossa between the exoccipital and squamosal.

The forehead is broad and nearly flat, the frontal sinuses producing hardly any convexity, and the postorbital processes are very feebly indicated. The nasals are short and very wide; anteriorly they have the same deep lateral notches as in the species previously described, but the median anterior processes are broader and more bluntly pointed. The hard palate is wide and uncommonly flat, being but slightly convex between the molariform teeth, and the vascular perforations are fewer and smaller than in most of the species, but in the fully adult animal the palate has a peculiar granulated appearance; the notch for the premaxillary is a deep, narrow U. The anterior nares are low and wide; the roof is formed entirely by the nasals, the maxillaries not curving inward dorsally, as they do in the species with narrow nasals.

Unfortunately, the mandible is unknown; a knowledge of it might necessitate the union of this species with *H. grandis*.

Measurements.

	No. 9,176.	*No. 15,596.*
Skull, length in median line (exclusive of premaxillæ)	.129	.125
" " from occipital condyles to anterior nares	.150	.152
" width at postorbital constriction	.036	.039
" " over lachrymals	.065	.068
Cranium, length, occipital condyle to rim of orbit	.116	.119
Face, length, orbit to anterior nares	.036	.034
Occiput, height	.046	.043
" width at base	.062	.067
Zygomatic arch, length	.084	.081
Length from occipital condyle to glenoid cavity	.027	.024
" " " " " $\underline{5}$	.082	.077
Rostrum, width at base	.034	.041

	No. 9,176.	*No. 15,596.*
Rostrum, width at anterior end		.033
Palate, length in median line	.049	.048
" width at $\underline{1}$	.021	.028
" " " preorbital fossæ	.026	.028
" " " $\underline{2}$	.015	.015
" " " $\underline{5}$	.014	.014

HAPALOPS ELONGATUS Ameghino.

(Plates XXXVII, Figs. 1–3, 5; XXXVIII, Figs. 1–3, 5; XXXIX, Figs. 1–3, 5; XL, Figs. 3, 4; XLI.)

Hapalops elongatus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 316.

Hapalops brevipalatus Amegh.; Ibid., p. 316.

Hapalops subquadratus Amegh.; Ibid., p. 317.

Xyophorus sulcatus Amegh.; Ibid., p. 320.

Schismotherium patagonicum Mercerat; Rev. del Mus. de la Plata, T. II, 1891, p. 9.

Stenocephalus hybridus Mercerat; Ibid., p. 12.

Eurysodon nasutus Mercerat; Ibid., p. 19.

To this most variable and protean species are here referred all those members of the present genus which agree in the following respects: (1) The caniniform teeth are small and of laterally compressed, oval section; (2) the molariform teeth are transversely rectangular, except $_{\overline{4}}$, which is subcylindrical; (3) the skull is relatively elongate, narrow and slender, with narrow muzzle and usually well-defined preorbital fossæ; (4) the occipital crest is thinner and better defined than in most of the other species of the genus and the supraoccipital is but moderately reflected upon the roof of the cranium; (5) in completely adult animals a low sagittal crest is present upon the frontals, but not upon the parietals; (6) the mandible has a relatively short, pointed predentary beak and the postero-external opening of the dental canal is upon the ascending ramus.

It is quite possible that more extensive and better preserved material may show that certain of the names in the list of synonyms given above represent distinct species, but, at present, no such separation is practicable, for most of these supposed species have been founded upon very incomplete and unsatisfactory types and in accordance with characters which are extremely inconstant.

The teeth (Plates XXXIX, figs. 1–3, 5; XL, fig. 3) display considerable variation in size, as is apparent from the subjoined table of measurements, but there is much less difference in form; $^{\underline{1}}$ is small, recurved, obliquely abraded, and of a compressed oval cross-section; it is inserted near the anterior edge of the maxillary, the palatine process of which extends a short distance in front of it, while the facial portion extends considerably farther, the diastema between $^{\underline{1}}$ and $^{\underline{2}}$ varies somewhat, but is of about the same relative length as in most of the other species. The molariform teeth are of rectangular or trapezoidal outline; $^{\underline{2}}$ is generally, though not always rectangular, while $^{\underline{3}}$ and $^{\underline{4}}$ are trapezoidal, and $^{\underline{5}}$ is always much the smallest of the series; the vertical grooving of these teeth appears to be very capriciously present or absent. The two rows of upper teeth may be either parallel, or, more commonly, slightly convergent backward. Of the lower teeth, $_{\overline{1}}$ is very small, erect and of cylindrical or slightly oval form; the diastema is short; $_{\overline{2}}$ and $_{\overline{3}}$ have the ordinary rectangular shape and $_{\overline{4}}$ is subcylindrical and somewhat irregular.

MEASUREMENTS.

	No. 15,597.	*No. 15,011.*	*No. 15,163.*	*No. 15,545.*
Upper dentition, length	.042	.043	.0435	.045
" " " $\underline{2\text{-}5}$	.028	.028	.027	.028
" " " $\underline{1\text{-}4}$	.036	.0375	.0375	.038
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.005	.0053	.0055	.005
" width (*i. e.*, transverse diameter)	.004	.004	.004	.0045
$\underline{2}$, length	.0055	.0053	.0055	.006
" width	.007	.0073	.007	.008
$\underline{3}$, length	.0065	.006	.006	.006
" width	.0085	.0085	.0075	.009
$\underline{4}$, length	.006	.006	.0055	.006
" width	.008	.008	.007	.0085
$\underline{5}$, length	.004	.0035	.003	.0045
" width	.0065	.006	.006	.006

	No. 15,597.	*No. 15,531.*	*No. 15,155.*
Lower dentition, length	.036	.035	.037
" " " $\overline{2\text{-}4}$	.025	.0245	.024
$\overline{1}$, length	.004	.005	.005
" width	.0043	.0045	.004
$\overline{2}$, length	.0063	.007	.0065
" width	.0083	.009	.008
$\overline{3}$, length	.0065	.007	.0063
" width	.0085	.0085	.008

	No. 15,597.	*No. 15,531.*	*No. 15,155.*
4, length	.008	.009	.007
" width	.0073	.008	.007

The skull (Plates XXXVIII, figs. 1–3, 5; XXXIX, figs. 1–3, 5, XL, figs. 1, 1^a) is very variable in the details of structure and proportion, so much so that no two specimens agree in these particulars, but on the other hand, they all have a general similarity of size and appearance. It is especially unfortunate that so few of the skulls are accompanied by the mandible, because the absence of that bone often leaves the specific reference a matter of uncertainty. In all of the specimens the skull is long and narrow, but considerable individual difference is observable in the relative width, especially of the muzzle. Usually the occiput is quite high and narrow, but varies considerably in proportionate height, and is either vertical or slightly inclined forward. From the occipital crest the upper contour of the skull rises with a degree of steepness which varies with the height of the crest, that of the parietal eminence remaining quite constant, and hence the rear view of the skull is very different in different individuals. Anteriorly from the eminence, the upper contour is remarkably straight, forming a long, gradual and regular descent to the end of the muzzle. The sagittal crest varies, probably with age, but is never conspicuous; it is absent, or, at most, very faintly indicated in the parietal region, but is always present on the hinder half of the frontals in the region of the postorbital constriction; this constriction varies much in depth and distinctness, but, as a rule, the whole anterior half of the skull is much more slender than the posterior half. The rostrum is short and narrow, with quite well-defined preorbital fossæ.

In none of the specimens are the sutures between the various occipital elements visible, and evidently they are early obliterated. The supraoccipital is produced for a short distance upon the dorsal side of the cranium, but less extensively than in most species of the genus; the occipital crest is moderately prominent on the sides, becoming almost obsolete dorsally, where it curves forward to accompany the supraoccipital. As a whole, the occiput is more or less convex, with median prominence for the vermis, but without well-defined lateral fossæ; the dorsal margin of the foramen magnum is extended so as to form a short tube. The condyles are small and sessile and usually approach each other quite closely on the ventral side, where the foramen magnum notches the relatively broad basioccipital. No distinct paroccipital processes are present.

The tympanic is a small, incomplete ring, with the usual very large and irregular auditory meatus. The alisphenoid is quite large, especially the descending process; dorsally, it articulates with the squamosal by means of two distinct processes, separated by the large opening which represents the combined foramina rotundum and ovale. The orbitosphenoid is small and has an irregular shape, its anterior border being deeply notched by the optic foramen and somewhat below and behind this by the foramen lacerum anterius. The parietals have about the same proportions as in the other species of the genus, but there is much individual variation in the degree of vaulting and in the consequent capacity of the cerebral fossa. The squamosal, jugal and lachrymal display no constant peculiarities. The frontals are characterized by their narrowness and elongation and by the constant presence on their posterior half of a sagittal crest, a low and thin ridge which is better developed in the older specimens. The fronto-nasal suture is very variable; usually it forms a single transverse curve, with concavity forward, interrupted in the middle by the very short median processes of the frontals, but sometimes these processes are conspicuous and divide the suture into two well-defined curves.

The nasals are short, rather broad and flat, or slightly convex; they are broadest behind, where they may be separated by the median processes of the frontals, and decidedly divergent; anteriorly, they have the usual deep lateral notches, producing the long, slender processes which accompany the maxillaries to the edge of the anterior nares; the median portion is broad and bluntly pointed.

The premaxillaries have the shape common to all the species of *Hapalops*, but the anterior branch is much shorter than in *H. longiceps* or *H. indifferens*, while the postero-external branch is broader and more depressed; the incisive foramina are narrow and slit-like. The maxillaries extend for some distance in front of the first tooth as a thin facial plate; the preorbital fossæ are distinct, but much more so in some individuals than in others. The palate varies much in width, in the degree of its anterior expansion and in convexity, no two individuals being alike in these respects, as is also true of the anterior median notch of the palate for the premaxillary spines, which is always broad and more or less U-shaped, but varies much in depth. The posterior nares have the usual shape, their side-walls curving downward in great, wing-like extensions of the alisphenoids, which usually cover the pterygoids on the outer side, but sometimes leave a strip of the latter exposed.

The mandible is fairly constant and characteristic, its principal variations being in size and in the position of the postero-external opening of the dental canal. The horizontal ramus is short, deep in the dentary region, but relatively less thickened than in many of the species; the predentary beak is quite short and narrow, rapidly contracting to the rounded anterior point; the profile of the chin is much steeper than in those species which, like *H. longiceps* and *H. indifferens*, have very elongate rostra. The ascending ramus is of the usual type; the coronoid has but moderate height and width and is less recurved than in *H. indifferens;* the condyle is small and set upon a relatively short neck, while the angular process is long, extending well behind the plane of the condyle, and dorso-ventrally broad, with the usual inflection. Typically, the external dental foramen is placed upon the ascending ramus, near the anterior margin and well above the base (see Plate XXXVII, Fig. 1), but in some instances it has a much more inferior position, approximating that which Ameghino has employed to characterize *Pseudhapalops* (see Plate XL, Fig. 4).

In the following table *No. 1* is the type specimen in the Ameghino collection and *No. 2* is a second individual in the same collection.

MEASUREMENTS.

	No. 1.	*No. 2.*	*No. 15,597.*	*No. 15,545.*	*No. 15,160.*	*No. 15,011.*
Skull, length in median basal line			.109	.113	.117	.112
" " occipital condyle to anterior nares	.136	.137	.136	.135	.136	.132
Cranium, length to anterior rim of orbit			.105	.101	.105	.101
Face, length from orbit to anterior nares			.032	.036	.032	.033
Occiput, height	.039	.038	.038	.037	.038	.045
" width at base		.047	.049	.052	.047	.050
Cranium, width at postorbital constriction			.026	.030	.029	.025
" " over lachrymals			.048	.050	.044	.046
" height of parietal eminence			.048	.047	.045	.048
Distance from occipital condyle to glenoid cavity			.020	.022	.023	.021
Palate, length in median line			.043	.048	.048	.046
" width at 1			.015	.019	.021	.018
" " " preorbital fossæ			.020	.022	.021	.021

	No. *1.*	*No.* *2.*	*No.* *15,597.*	*No.* *15,545.*	*No.* *15,160.*	*No.* *15,011.*
Palate, width at $\underline{2}$	.013		.011	.012	.012	.010
" " " $\underline{5}$	.010		.011	.012	.011	.010
Rostrum, width over $\underline{1}$			.026	.030	.029	.030

	No. *15,597.*	*No.* *15,155.*	*No.* *15,531.*
Mandible, length from condyle	.107		?.105
" " " angle	.114	.113	
" " of predentary beak	.026	.026	?.026
" depth at $_{\overline{5}}$	.025	.024	.027
" height of coronoid	.053		.051

Vertebral Column, Ribs and Sternum. — The vertebral column has the following formula: C.7; Th. 21–22; L. 3–4; S. 5–6; Cd ± 20.

The atlas is relatively longer, higher and narrower than in *H. longiceps* and the neural arch is separated from the posterior cotyles; the neural canal is higher and narrower than in the latter species and the transverse processes are smaller; the internal branch of the vertebrarterial canal is an open groove. The axis has a well-defined ventral keel, the facets for the atlas rise higher upon the sides of the neural canal, but project less below the centrum than in *H. longiceps;* the odontoid process is relatively long and slender; the neural canal is high and narrow and the spine is a hatchet-like plate, much more extended antero-posteriorly in some individuals than in others. The third cervical has a short, broad, depressed centrum, with indistinct ventral keel; the neural arch is broad, the canal relatively large and the spine is a low ridge; the transverse process, which is perforated by a short canal, does not project far outward from the side of the centrum, but is much extended antero-posteriorly; the pleurapophysial element is divided into nearly equal anterior and posterior portions, of which the former is rather more slender and pointed. The fourth cervical resembles the third, but has a slightly longer and narrower centrum, smaller neural canal, and more distinct spine. In the fifth, the spine is still more distinct and the anterior division of the transverse process is considerably shortened. The sixth vertebra differs from the fifth chiefly in the character of the transverse process, which is clearly distinguished into diapophysial and pleurapophysial elements; the latter is a large, compressed plate, which projects far below the level of the centrum; the neural arch is very narrow antero-posteriorly. The seventh cervical has a broader centrum than the sixth, with long, imperforate transverse processes, which are slightly expanded at the distal end, terminating in a recurved hook; the neural arch is very narrow and the spine, through far shorter and more slender than that of the first thoracic, is yet much larger than on any other cervical.

As a whole, the neck is short and slender, narrowing posteriorly, but increasing in dorso-ventral thickness, owing to the successively longer spines.

The first thoracic has a centrum which about equals in size that of the seventh cervical, and the prezygapophyses are of cervical type; the neural canal is low and wide, the arch is very broad and the spine, though but moderately developed, is yet the largest in the anterior part of the thorax; this spine is elongate, broad and quite thick, and is expanded at the tip, making the anterior and posterior borders concave, but with only a slight backward inclination. The transverse processes are long, straight and expanded at the ends, which bear deep concavities for the tubercles of the first pair of ribs. The second thoracic differs considerably from the first, having a smaller centrum, much shorter transverse processes, and a longer, more slender and more inclined neural spine; the prezygapophyses are still quite widely separated by a deep notch. In the succeeding vertebræ the centra are reduced, their small size in this region being one of the most characteristic features of the vertebral column; the neural spines become shorter, more slender and more steeply inclined; the transverse processes shorter and small, club-like metapophyses begin to appear upon their bases.

This type of vertebra continues to the eight thoracic, after which the centra begin to enlarge and increase regularly in size backward, those in the hinder part of the region being far larger than those in the forward part; on the last nine vertebræ are the two foramina opening on the ventral side of the centra, though, for the most part, these foramina are quite small. The neural arches are very broad in both directions and the spines become broader, thicker and more erect, though the spines of all the trunk-vertebræ have a more or less decided backward inclination. The last four thoracic vertebræ are of quite a different type from those which precede them and are unlike the lumbars; the neural spines are rather short, but broad antero-posteriorly, and have but a slight backward slope; the transverse processes bear no distinct facets for the tubercles of the ribs, but on the last thoracic that for the head of the last rib is like a step cut in the base of the transverse process; short anapophyses are given off from the hinder borders of the transverse processes. The postzygapophyses of the last three thoracics and the prezygapophyses of the last two have the semicylindrical form characteristic of the lumbar region; the accessory postzygapophyses first appear on the nineteenth thoracic, as small, ventrally facing facets, overlapping the accessory prezygapophyses of the twentieth vertebra, which are carried upon small, shelf-like projections from the base of the principal pair of prezygapophyses.

The lumbar vertebræ have broad and depressed centra, with two large foramina opening upon the ventral side of each; the neural spines are somewhat longer than those of the posterior thoracic region, but rather narrower and more erect; the transverse processes are broad, depressed and thin, but of no great length; the metapophyses diminish in size posteriorly and on the second lumbar are smaller than those of the last three thoracics; the zygapophyses and accessory articular processes are like those, already described, of the posterior thoracic region, and no additional ones appear upon the lumbars.

The sacrum consists of five vertebræ, all of which are large, though decreasing in size posteriorly; the centra are broad and much depressed and are slightly concave on the ventral side, with ventral foramina on the first, fourth and fifth; the neural canal is wide and low; the foramina for the passage of the sacral nerves are large, especially those between the second and third vertebræ. The first sacral has well developed prezygapophyses and the last bears much smaller postzygapophyses; those of the other vertebræ are indicated by roughened tubercles, and the neural spines are fused into a continuous ridge. Even in quite young individuals no division of the transverse processes into dia- and pleurapophysial elements is apparent; the first and second sacrals have large processes for articulation with the ilia, and the third has smaller processes, which touch the ilia only by the anterior border, while those of the fourth do not reach the pelvis and those of the fifth are connected with the ischia.

As no specimen with a complete tail has yet been found, the number of caudal vertebræ is uncertain, but as in the other species of the genus, was probably about twenty, and they are relatively less heavy than in the large species. The first caudal has a short, broad and thick centrum and very elongate transverse processes, which are narrow and of only moderate thickness; the neural canal is still quite large and the spine prominent and heavy. Passing backward, the successive centra gradually lose the broad, subcubical form and tend to assume a more cylindrical shape; the neural canal diminishes in size, but is complete to the tenth or eleventh vertebra, and zygapophyses are present on the same number, the anterior pair always much exceeding the posterior in size; the transverse processes grow shorter and relatively wider and are especially expanded at the distal ends, where many of them are more or less distinctly bifid. Near the end of the tail the vertebræ are very small and the processes rudimentary.

In the anterior and middle regions of the tail the chevron-bones are Y-shaped, as in *Megatherium*, but with relatively shorter hæmal spines; these spines are longest in the anterior region and diminish posteriorly in length, but retain or even increase their fore-and-after breadth. Proximally, the chevrons bear two pairs of facets for the vertebral centra, of which the anterior pair is larger and persists longer, the posterior pair becoming mere roughened ridges. In the hindermost part of the tail the chevrons are canoe-shaped, very short proximo-distally, elongated antero-posteriorly and pointed at both ends, much as in the armadillos and glyptodonts.

As a whole, the vertebral column displays an interesting combination of characters; its nearest resemblance is to the type of the Pleistocene Gravigrada, but with such differences as might be expected in a more ancient, more primitive and very much smaller and lighter animal, while the very elongate trunk is much like that of *Cholœpus*. The actual length of the presacral part of the vertebral column is almost the same as in *Myrmecophaga jubata*, but in proportion to the skull and limbs it is far longer, while the tail is much shorter.

The ribs are incompletely known, but the parts of the thorax are sufficiently represented in the various individuals to give a good idea of the whole. The first rib is very short and has a long, straight and very slender neck and a large, saddle-shaped tubercle; the shaft has its broad side directed forwards and expands distally, where it is fused with the sternal rib. Most of the succeeding ribs are relatively rather short and are strikingly rod-like and slender, forming a decided contrast to those of the larger species, such as *H. longiceps;* in the hinder portion of the thorax the tubercles are sessile and obscurely indicated, but apparently only the last rib lacks the tubercle entirely. Seen from the side, the longer ribs display a double curvature, somewhat as in *Cholœpus*, though in a less marked degree.

The sternal ribs are thin and blade-like, antero-posteriorly compressed, and with principal diameter directed dorso-ventrally; the distal end bears a facet for the body of the mesosternal segment, and a rounded, tubercle-like projection for the ventral process of the segment.

The sternum is imperfectly known and it is not possible to determine the number of segments of which it is composed. The manubrium, which bears considerable resemblance to that of *Cholœpus*, is of cruciform shape, with long, narrow anterior projection; the body of the presternum is broad, deeply concave on the dorsal side, and with narrow, elongate and saddle-shaped facets for the first pair of ribs; the posterior end is narrowed and has a smooth surface for the first segment of the mesosternum; this surface presents obliquely upward and backward. The segments of the mesosternum resemble those of *Mylodon*, as is true of all the Santa Cruz Gravigrada in which this structure is known. Each segment consists of a flat, depressed plate, with slightly concave anterior and convex posterior faces, and at the angles are facets for the heads of the sternal ribs; from the ventral side of the plate arises a very large, club-shaped process, with constricted neck, which carries four concave facets for the tubercles of the sternal ribs; except for these facets, the surface of the process is everywhere rugose. No specimen containing the xiphisternum has yet been found.

The following measurements of the vertebræ are from No. 15,545, except those of the lumbar vertebræ, which are taken from No. 15,011.

MEASUREMENTS.

Neck, length	.140	Third cervical, length of centrum	.018
Thorax, length (following curve)	.416	" " width of anterior face	.0125
Loins, length	.099	" " " " posterior face	.014
Sacrum, length	.115	Fourth cervical, length of centrum	.017
Atlas, length	.030	" " width of anterior face	.013
" width	.050	" " " " posterior face	.014
" dorso-ventral height	.0265	First thoracic, length of centrum	.018
Axis, length of centrum	.025	" " width of anterior face	.014
" width of anterior face	.029	" " " " posterior face	.017
" " " posterior face	.013	First thoracic, width over transverse processes	.050
" " " neural spine	.026		

MEASUREMENTS.

First thoracic, height of spine from centrum	.038
First thoracic, width of spine at tip	.017
Third thoracic, length of centrum	.019
" " width over transverse processes	.041
Third thoracic, height of neural spine	.033
" " width of neural spine at tip	.010
Last thoracic, length of centrum	.021
" " width of anterior face	.022
" " width over transverse processes	?.049
Last thoracic, height of neural spine	.040
" " width of neural spine	.018
First lumbar, length of centrum	.025
" " width of anterior face	.025
" " width over transverse processes	.080
First lumbar, height of neural spine	.044
" " width of spine at tip	.020
Second lumbar, length of centrum	.026
" " width of anterior face	.025
Third lumbar, length of centrum	.023
" " width of anterior face	.026
" " width over transverse processes	.064
Third lumbar, height of neural spine	.047
Fourth lumbar, length of centrum	.025
" " width of anterior face	.026
" " height of neural spine	.045

First sacral, width of anterior face	.029
Last sacral, width of posterior face	.026
First caudal, length of centrum	.019
" " width of anterior face	.023
" " width over transverse processes	.076
Second caudal, length of centrum	.018
" " width of anterior face	.023
" " width over transverse processes	.070
Third caudal, length of centrum	.020
" " width of anterior face	.021
" " width over transverse processes	.060
Fourth caudal, length of centrum	.021
" " width of anterior face	.020
" " width over transverse processes	.056
Fifth caudal, length of centrum	.021
" " width of anterior face	.019
" " width over transverse processes	.055
Sixth caudal, length of centrum	.020
" " width of anterior face	.018
" " width over transverse processes	.052
Seventh caudal, length of centrum	.019
" " width of anterior face	.016
" " width over transverse processes	.046

Appendicular Skeleton.—The scapula has a short, broad blade, divided by the spine into fossæ of nearly equal width; the suprascapular border is quite short and anteriorly curves gradually into the coracoid border, while behind it forms a decided angle with the glenoid border; the latter is much thickened on the neck of the scapula and, though thinning away proximally, remains a distinct ridge for most of its length. The neck of the scapula, even excluding the coracoid, is very broad and short. The spine is of moderate height and pursues a somewhat curved course, ending in a very large acromion, which unites with the coracoid, as in all known Gravigrada. The coracoid is very large, forming the anterior third of the glenoid cavity and, proximal to this cavity, expanding into a broad plate, which is suturally connected with the blade of the scapula and eventually fuses with it, while a shorter and more rod-like process coalesces with the acromion. The coracoscapular foramen is quite small and of subcircular shape.

The clavicle is rather slender and is more curved than in *Megalonyx*, less than in *Megatherium* or *Mylodon*; this curvature is single and presents the convexity forward; the sternal end is moderately expanded.

The humerus (Plate XLI, fig. 4) is very like that of *H. longiceps*, but much smaller and lighter; the proximal end is shaped much as in *Megalonyx*, though the tuberosities are more widely and distinctly separated and their proportions are reversed, the inner one exceeding the outer in size; the bicipital groove is broad and shallow; the deltoid area is relatively somewhat narrower than in *H. longiceps* and has less elevated borders. The distal trochlea is proportionately narrower than in the latter species and the radial part of the trochlea is relatively larger and more hemispherical, while the ulnar facet is narrower and has a less prominent inner flange. Otherwise, the distal end is almost exactly as in *H. longiceps*.

Except for their smaller size and somewhat more slender proportions, the ulna and radius are so like those of the larger species as to require no extended description.

Very little of the manus is preserved in association with any of the specimens and the few parts that are known differ only in size from the corresponding parts of *H. longiceps*.

MEASUREMENTS.

	No. 15,545.	*No. 15,160.*	*No. 15,597.*	*No. 15,155.*
Scapula, length of blade				.101
“ greatest width of blade				.082
“ width of glenoid cavity				.019
Humerus, length	.151	.152		
“ width of proximal end	.040	.040		
“ “ “ distal trochlea	.028	.030		
“ “ “ “ end over epicondyles		.060		
Radius, width of proximal end	.019	.018		
“ “ distal end	.023	.021		
Ulna, length		.156		
“ “ of olecranon	.025	.026	.025	

	No. 15,545.	*No. 15,160.*	*No. 15,597.*	*No. 15,155.*
Ulna, width at sigmoid notch	.022	.020	.020	
Metacarpal II, length				.0295
" " width of proximal end				.017
" " " " distal end				.0115
" " thickness of distal end				.016

Save in size, the pelvis differs little from that of *H. longiceps*. The ilium is quite long and broad and runs nearly parallel with the sacrum, though somewhat everted at the anterior end; the acetabular border is external, making the broad gluteal surface dorsal, as in all this group. The ischium is much shorter than the ilium and the sacro-sciatic foramen is a longitudinal oval. The pubis is a slender, compressed rod and the symphysis is short; the obturator foramen is triangular, with principal diameter parallel with the pubis.

The femur (Plate XLI, fig. 5) is relatively longer and more slender than in *H. longiceps*, though there is little difference in appearance; the head is small and hemispherical and on its postero-internal side, hardly visible from the front, is the pit for the round ligament, a large, irregular depression, which does not extend to the margin of the articular surface; the great trochanter is less prominent than in *H. longiceps* and the notch between this process and the head is shallower; the second trochanter is extended well down upon the inner side of the shaft, while the third trochanter has a little more proximal position than in the larger species. The shaft is less antero-posteriorly compressed than in the latter and its surfaces are more convex. The distal tuberosities are less developed.

The patella is long, narrow and thin; its distal prolongation is much narrower than in *H. longiceps*, remarkably so in some individuals.

The tibia and fibula (Plate XLI, fig. 6) differ little, except in size, from those of *H. longiceps*, but much individual variation, due partly to differences of age, is observable; the only feature calling for notice is the flatness of the astragalar facet of the tibia.

The pes (Plate XLI, figs. 1–3, 7) is of a type entirely similar to that of *H. longiceps*, differing only in a few details, but the variations in the form of the calcaneum and astragalus are remarkable, no two specimens of these bones being in all respects alike. The astragalus has the narrow, elongate shape seen in all the species of the present genus, but the trochlea is much less distinctly grooved than in *H. longiceps* and is less deeply invaded by the notch from the distal end, while the facet for the navicular is somewhat less deeply concave. The calcaneum has much the same general shape as in *H. longiceps*, but the tuber is thinner planto-dorsally and is less expanded and rugose at the free, or proximal end; this difference is especially marked in the younger and smaller individuals; the position of the two facets for the astragalus and of the cuboid facet differs more or less in every specimen, though they are essentially similar to the corresponding surfaces on the calcaneum of *H. longiceps*. The remaining bones of the tarsus display no peculiarities that require notice.

The metatarsals resemble those of the larger species, with the quite constant exception that metatarsals IV and V are shorter in proportion to the length of metatarsal III, and that the latter, though extremely short and heavy, is yet rather less massive.

The phalanges differ only in size from those of *H. longiceps*.

MEASUREMENTS.

	No. 15,011.	*No. 15,545.*	*No. 15,160.*	*No. 15,597.*	*No. 15,155.*
Pelvis, length	.197	.200			
“ greatest width	.225	.235			
Ilium, length	.114	.115			
“ greatest width	.075	.077			
Ischium, length	.083	.085			
Acetabulum, antero-posterior diameter	.034	.032			
Femur, length from head		.172			
“ “ “ great trochanter		.175			
“ width of proximal end		.063			
“ “ “ distal end over tuberosities		.054			
“ “ “ “ “ “ condyles		.048			
“ “ “ rotular trochlea		.024			
Patella, length		.032			.038
“ greatest width		.025			.022
Tibia, length				.124	
“ width of proximal end		.049			.051
“ thickness of proximal end		.039		.040	.041
“ width of shaft in middle		.018		.0175	
“ thickness of shaft in middle		.015		.015	
“ width of distal end				.043	
“ thickness of distal end				.021	.021
Fibula, length		.121			
“ width of proximal end		.013			
“ thickness of proximal end		.020			

	No. 15,011.	*No. 15,545.*	*No. 15,160.*	*No. 15,597.*	*No. 15,155.*
Fibula, width of shaft in middle		.008			
“ thickness of shaft in middle		.010			
“ width of distal end		.021			
“ thickness of distal end		.018			
Calcaneum, length					.057
“ width of proximal end					.047
“ “ at constriction					.015
“ “ of distal end		.023			.023
Astragalus, length		.031			.032
“ width of trochlea		.021			.0225
“ “ “ distal end		.016			.016
Metatarsal I, length			.013		
“ “ proximal width			.007		
“ “ distal width			.007		
“ “ “ thickness			.009		
Metatarsal II, length	.022		.024		.024
“ “ proximal width	.012		.013		.013
“ “ distal width	.010		.011		.011
“ “ “ thickness	.016		.017		.016
Metatarsal III, length	.020	.024	.022		.023
“ “ proximal width	.016	.017	.017		.017
Metatarsal III, distal width	.015	.015	.015		.015
“ “ “ thickness	.020	.022	.020		.021
Metatarsal IV, length	.035	.040			.041
“ “ proximal width	.013	.012			.013
“ “ distal width	.010	.011			.011
“ “ “ thickness	.016	.018			.017
Metatarsal V, length	.029				.035
“ “ proximal width	.025				.026
“ “ distal width	.007				.009
“ “ “ thickness	.009				.010
First phalanx, digit II, length					.011
“ “ “ “ proximal width					.012
“ “ “ “ “ thickness					.017
First phalanx, digit III, length					.013
“ “ “ “ proximal width					.013
“ “ “ “ “ thickness					.020
Second phalanx, digit II, length					.020
“ “ “ “ proximal width					.0095
“ “ “ “ “ thickness					.017
Ungual, digit II, length					.036
“ “ “ proximal thickness					.0155
Ungual, digit III, length					.047
“ “ “ proximal thickness					021

HAPALOPS ANGUSTIPALATUS Ameghino.

(Plate XLIII, Figs. 2–5.)

Hapalops angustipalatus Amegh.; Rev. Argent. Hist. Nat., Vol. I, 1891, p. 316.

This is another species of doubtful validity, for it may very well prove to be identical with some of the species which have been established upon the mandible alone. The type specimen is the facial portion of a skull, with all of the teeth, except $^{\underline{5}}$, in position. In the Princeton collection the species appears to be represented by a specimen (No. 15,562), comprising a considerable part of the skeleton, which was collected by Mr. Hatcher at Corriken Aike. This individual consists of the skull, of which only the base is preserved, without mandible, seven thoracic and four lumbar vertebræ, parts of the scapula and humerus, the radius, ulna, metacarpals II and III, femur, patella, tibia and part of the pes.

H. angustipalatus is distinctly larger than *H. elongatus;* individuals of the latter yield measurements which form a series of gradations from the smaller to the larger specimens, while the dimensions of *H. angustipalatus* are separated by a wide gap from those of the largest representatives of *H. elongatus.* Another difference from the latter is in the relative size and proportions of the skull, which is considerably smaller in comparison with the vertebræ and limb-bones, and broader in proportion to its length than in the last named species.

The teeth are not especially characteristic; the caniniforms ($^{\underline{1}}$) are relatively large, sharply pointed by abrasion and are placed somewhat more externally to the line of the other teeth than is usual in this genus. The molariform teeth are large and of more or less distinctly rectangular outline, except $^{\underline{5}}$, which is very small and transversely oval.

The skull is relatively broader than in most examples of *H. elongatus* and the occipital condyles and foramen magnum are larger, while the basioccipital and basisphenoid are broad and quite flat transversely. The descending processes of the alisphenoids and the pterygoids, which form the side-walls of the posterior nares, are less produced downward than in *H. elongatus.* The hard palate is more decidedly convex between the molariform teeth than in the latter species and wider between the caniniforms, while the anterior median notch for the premaxillary spines is distinctly smaller. On the other hand, the preorbital fossæ of the maxillaries are deeper, producing a stronger constriction of the palate at the diastema.

MEASUREMENTS.

Upper dentition, length	.046
" " " $\underline{2}$–$\underline{5}$	.030
" " " $\underline{1}$–$\underline{4}$	.0385
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.006
" width (*i. e.*, transverse diameter)	.005
$\underline{2}$, length	.006
" width	.008
$\underline{3}$, length	.007
" width	.009
$\underline{4}$, length	.006
" width	.0085
$\underline{5}$, length	.005
" width	.007
Skull, length in median line	.122

Skull, length occipital condyles to anterior nares	.145
Cranium, length to edge of orbit	.116
Face, length orbit to anterior nares	.033
Occiput, width at base	.057
Skull, width over lachrymals	.055
Zygomatic arch, length	.083
Occipital condyle to glenoid cavity, length	.023
Occipital condyle to $\underline{5}$, length	.071
Palate, length in median line	.045
" width at $\underline{1}$	.020
" " " preorbital fossæ	.023
" " " $\underline{2}$	.013
" " " $\underline{4}$	.0115
Rostrum, width over $\underline{1}$	.034

The thoracic vertebræ, especially those from the posterior part of the region, are considerably larger than the corresponding ones of *H. elongatus*, more so than would be expected from a comparison of the skulls alone; they have higher, broader, thicker and more erect spines. Only on the last thoracic are the small ventral foramina visible.

The lumbar vertebræ (Plate XLIII, fig. 5, 5^a 5^b) form a series of four, which in this specimen are in an unusually complete state of preservation. The centra are broad and depressed, increasingly so toward the sacrum, and, although this animal is fully adult, the ventral openings of the canals which traverse the centra are very conspicuous, especially on the second vertebra, becoming quite small on the last. The neural spines are higher, broader, more thickened at the free end and less inclined backward than in *H. elongatus;* the transverse processes are quite short, broad and depressed, and are curved forward, they are longest on the second lumbar. The accessory articular processes, which are particularly well shown in this individual, are of the type already described as characteristic of the *Megalonychidæ.* Two pairs of such processes are developed, an anterior pair placed upon a shelf-like projection of the neural arch, ventral and external to the prezygapophyses, and a posterior pair which arise from the hinder angulation of the transverse processes.

The ribs, so far as they are preserved, are similar to those of *H. elongatus* but are relatively somewhat broader and stouter.

The two segments of the mesosternum (Plate XLIII, figs. 3, 3^a, 4, 4^a) most resemble the second and fifth segments of *Mylodon* (Owen, '42, Pl. IX) to which they closely conform in plan of structure; the dorsal portion of the more anterior segment is an elongate and narrow plate, broadening and becoming more depressed posteriorly; the ventral portion is correspondingly elongate antero-posteriorly. The eight facets for the sternal ribs are as in all the other Santa Cruz Gravigrada in which the sternum is known. The more posterior segment is much broader and the ventral part is much less extended in the fore-and-aft direction.

MEASUREMENTS.

Last thoracic, length of centrum	.025
" " width of anterior face	.027
" " " over transverse processes	.056
" " height of neural spine	.036
" " width of neural spine at base	.023
" " width of neural spine at tip	.022
First lumbar, length of centrum	.027
" " width of anterior face	.030
" " height of neural spine	.038
" " width of spine at base	.023
" " " " " " tip	.023
Second lumbar, length of centrum	.028
Second lumbar, width of anterior face	.030
" " " over transverse processes	?.100
" " height of neural spine	.041
Third lumbar, length of centrum	.027
" " width of anterior face	.031
" " " over transverse processes	.092
" " height of neural spine	.036
Fourth lumbar, length of centrum	.025
" " width of anterior face	.033
" " " " posterior face	.037
" " height of neural spine	.031
" " width of spine at tip	.023

The bones of the fore-limb closely resemble those of *H. elongatus* but are somewhat longer and decidedly heavier. The scapula differs in a number of particulars, having a more sinuous coracoid border and broader prescapular fossa; the glenoid cavity is more deeply concave and the spine bears a more distinct metacromion.

Of the humerus, somewhat less than the distal half is preserved; in the trochlea the articular surface is continuous, as is usual throughout the order, and yet the groove between the radial and ulnar facets is considerably deeper than in *H. elongatus* and the latter has a shorter proximo-distal diameter, being reflected less upon the dorsal face of the bone;

the internal epicondyle and the supinator ridge are very heavy and prominent, but the supratrochlear and anconeal fossæ are even shallower than in the last named species.

The ulna is but little longer than that of *H. elongatus* and considerably stouter; the olecranon is somewhat broader at the free end and the humeral facet is of a rather different shape, being wider and also extending farther up on the external side. The shaft is quite heavy and the strongly convex curvature of the posterior border gives it quite a different appearance from that of the preceding species.

The radius differs very little, except in being heavier, from that of *H. elongatus;* the broadening of the shaft below the proximal half is somewhat greater and more abrupt and on the anterior side of the distal end is a broad and deep sulcus for the extensor tendons; the carpal facet is unusually concave.

Measurements.

Scapula, width	.089
“ antero-posterior diameter of glenoid cavity	.029
Scapula, width of glenoid cavity	.022
Humerus, width of distal trochlea	.034
“ “ “ “ end over epicondyles	.065
Ulna, length	.161
“ “ of olecranon	.027
“ width at sigmoid notch	.024
“ “ of distal end	.013
Radius, length	.137
“ width of proximal end	.020
“ “ “ distal end	.026
Metacarpal III, length	.033
“ “ proximal width	.0195
“ “ distal width	.013
“ “ “ thickness	.0185
Metacarpal IV, length	.038
“ “ proximal width	.010
“ “ distal width	.012
“ “ “ thickness	.015

The femur differs considerably from that of *H. elongatus*; the head is larger and rises considerably above the level of the great trochanter, and the pit for the round ligament is extended to the edge of the articular surface; the great trochanter is lower and there is no notch between this process and the head; the shaft is considerably broader and more compressed antero-posteriorly, while the third trochanter and external tuberosity are more prominent; the rotular groove is shallower.

The tibia differs from that of the preceding species only in its length and greater relative stoutness, and the same description applies to the calcaneum and metatarsals III and IV. Compared with *H. elongatus*, the hind limb exceeds the fore limb more in length.

MEASUREMENTS.

Femur, length from head	.190
" " " great trochanter	.187
" width of proximal end	.071
" " " distal end over tuberosities	.065
" " " distal end over condyles	.054
Patella, length	.039
" greatest width	.029
Tibia, length	.140
" width of proximal end	.055
" thickness of proximal end	.043
" width of shaft in middle	.020
" thickness of shaft in middle	.019
" width of distal end	.046
Tibia, thickness of distal end	.023
Calcaneum, length	.065
" width of proximal end	.053
" " at constriction	.020
" " of distal end	.025
Metatarsal III, length	.027
" " proximal width	.019
" " distal width	.017
" " distal thickness	.0235
Metatarsal V, length	.035
" " proximal width	.033
" " " thickness	.015
" " distal width	.010
" " " thickness	.012

? HAPALOPS PONDEROSUS, sp. nov.

(Plate LIV, Figs. 2, 2ª.)

A large species which may perhaps be referable to *Hyperleptus* rather than to *Hapalops*, but the median notch of the palate which receives the premaxillary spines would seem to indicate that the premaxillæ had the shape chararteristic of the present genus.

The type specimen (Princeton Museum, No. 15,520) consists of the skull, without mandible, humerus, femur, proximal half of the tibia, and the calcaneum; it was collected by Mr. Hatcher, probably at Corriken Aike.

The first upper tooth is small, of longitudinally oval section and abraded almost horizontally. The molariform teeth are unusually large and rectangular, not quite like those of any other specimen; $\underline{2}$ is of almost square section; $\underline{3}$ is a transverse rectangle and the largest of the series; $\underline{4}$ is similar, but a little smaller, while $\underline{5}$ is much reduced in size. The two series of molariform teeth are almost exactly parallel, making the palate of uniform width between them.

MEASUREMENTS.

Upper dentition, length	.062
" " $\underline{2-5}$	.041
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.007
" width (*i. e.*, transverse diameter)	.006
$\underline{2}$, length	.008
" width	.010
$\underline{3}$, length	.009
" width	.0115
$\underline{4}$, length	.008
" width	.011
$\underline{5}$, length	.006
" width	.009

The skull also is of a somewhat peculiar type. The occiput is quite high and slopes forward and upward more than in most species of *Hapalops*. From the occipital crest the upper contour of the skull rises slightly to the parietal eminence, which is quite low, and thence descends very gradually to the muzzle, so that the dorso-ventral diameter of the skull is nearly uniform throughout. The brain-case is broad and capacious, the postorbital constriction shallow and the expansion forward from it unusually gradual; the sagittal crest is not developed, save for a short distance upon the frontals, which on the sides are uncommonly concave to form the wall of the orbits; the preorbital fossæ are of moderate depth.

The occiput is broadly convex, with a median ridge for the vermis of the cerebellum and a shallow fossa on each side; the condyles are quite large, projecting well below the level of the basioccipital and are widely separated by the large foramen magnum. The occipital crest is quite prominent on the sides, becoming inconspicuous dorsally, where the supraoccipital is reflected for a short distance upon the cranial roof. The hard palate is moderately convex between the molariform teeth, flattening anteriorly; its rugosities receive a somewhat characteristic appearance from their being arranged in three or four longitudinal rows, or ridges; the median notch for the premaxillary spines is broad and U-shaped.

MEASUREMENTS.

Skull, length in median basal line.	.148	Skull, width over lachrymals	.056
" " condyle to anterior nares.	.174	Zygomatic arch, length	.100
Cranium, length from condyle to rim of orbit	.135	Distance from condyle to glenoid cavity.	.027
Face, length from rim of orbit to anterior nares	.043	" " " " $\underline{5}$	.087
Occiput, height	.046	Palate, length in median line	.060
" width at base	.065	" width at $\underline{1}$	.026
Skull, width at postorbital constriction.	.036	" " " preorbital fossæ	.029
		" " " $\underline{2}$	.018
		" " " $\underline{5}$	.019

The humerus differs but little from that of *H. longiceps;* the shaft is somewhat more slender, the deltoid area narrower, with less rugose and prominent edges; the distal trochlea is rather wider and has a more hemispherical facet for the radius, while the anconeal fossa is distinctly deeper; the internal epicondyle is quite as massive and prominent, but the bony bridge over the foramen is considerably narrower.

The femur also is very like that of *H. longiceps* in size and proportions; the head is somewhat larger and the pit for the round ligament is of more pyriform shape, its apex extending to the hinder margin of the articular surface. The great trochanter is relatively higher, making deeper the notch between itself and the head; the digital fossa is larger and deeper, more so than in any other specimen in the collection; the third trochanter has about the same relative position as in *H. longiceps*, but projects more prominently and is narrower proximo-distally. The shaft is broader, especially its proximal portion. The rotular groove is broad and shallow, with raised internal border, while the tuberosities are unusually large and rugose.

In the tibia, so far as it is preserved, the only noteworthy difference from that of *H. longiceps* is the greater slenderness of the shaft.

The calcaneum resembles that of the last named species; the proximal end of the tuber is more expanded and less oblique, making the lateral borders more concave; the external astragalar facet is larger, and the projection from the outer side of the distal end more prominent.

MEASUREMENTS.

Humerus, length	.194	Femur, width of distal end over tuberosities	.078
" width of distal end over epicondyles	.075	" " " rotular groove	.032
" " " " trochlea	.041	Tibia, width of proximal end	.072
Femur, length from head	.216	" thickness of proximal end	.051
" " " great trochanter	.219	Calcaneum, length	.076
" width of proximal end	.090	" width of proximal end	.066
" " " shaft above second trochanter	.070	" " at constriction	.023
" " " distal end over condyles	.069	" " of distal end	.032

HAPALOPS INFERNALIS Ameghino.

Eucholœops infernalis Amegh.; Enumeracion sistem., etc., 1887, p. 21.

Pseudhapalops infernalis Lydekker; Anales del Museo de La Plata, T. III, 1894, p. 103.

As Lydekker has pointed out (loc. cit.), this species is not referable to *Eucholœops*. Unfortunately, the type specimen, the anterior part of a skull, is in a much damaged condition, but apparently indicates a species different from any of the preceding representatives of *Hapalops*. The upper caniniform ($^{\underline{1}}$) is of medium size and of the usual compressed oval section; it is inserted somewhat behind the anterior border of the maxillary and is separated by quite a long diastema from $^{\underline{2}}$. The two series of molariform teeth are almost exactly parallel, making the palate of uniform width in this region. These teeth ($^{\underline{2-5}}$) are characterized by their relatively large antero-posterior diameter; in shape they are rectangular with rounded angles; $^{\underline{3}}$ is the largest and $^{\underline{5}}$ the smallest of the series.

The preorbital fossæ of the maxillaries are unusually deep.

MEASUREMENTS.

Upper dentition, length	.060	$\underline{3}$, width	.010
" " " $\underline{2-5}$	.035	$\underline{4}$, length	.006
Diastema, length	.017	" width	.009
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.008	$\underline{5}$, length	.0055
" width (*i. e.*, transverse diameter)	.006	" width	.008
$\underline{2}$, length	.006	Palate, width at preorbital fossæ	.030
" width	.008	" " " $\underline{2}$	.016
$\underline{3}$, length	.008	" " " $\underline{5}$	.016

HAPALOPS ROSTRATUS Ameghino.

(Plate XLIII, Figs. 1, 1^a.)

Xyophorus rostratus Amegh. Enumeracion sistem., etc., 1887, p. 23.
? *Xyophorus simus* Amegh., Ibid., p. 23.

Although the type of this species is an unsatisfactory fragment of the mandible belonging to a very young animal, the name may be employed for those small representatives of *Hapalops*, with very short predentary beak of the mandible, which Ameghino has placed in a distinct genus, *Xyophorus*. The following description is taken from a specimen in the Princeton collection, which consists of an imperfect skull, with mandible, one lumbar, five sacral and four caudal vertebræ, the right os innominatum, part of the right radius and femur and two phalanges of the pes.

So far as the teeth are concerned, this species hardly differs at all from *H. elongatus*; $^{\underline{1}}$ is of slightly compressed, longitudinally oval cross-section, and is obliquely bevelled by abrasion; $^{\underline{2}}$ is quite small and of subquadrate form; $^{\underline{3}}$ has a transversely rectangular shape, while $^{\underline{4}}$ has some tendency to assume a transversely oval shape. In the mandible, $_{\overline{1}}$ is of quite different size and form on the two sides, being noticeably lower and broader on the right side than on the left; the diastema is very short. The only other tooth preserved is $_{\overline{2}}$, which is of the usual form.

MEASUREMENTS.

Length of diastema between $^{\underline{1}}$ and $^{\underline{2}}$	.014
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.0055
" width (*i. e.*, transverse diameter)	.005
$^{\underline{2}}$, length	.006
" width	.0065
$^{\underline{3}}$, length	.006
" width	.0075
$^{\underline{4}}$ length	.005
$^{\underline{4}}$, width	.0075
Lower dentition, length	.033
" " " $_{\overline{2}}$–$_{\overline{4}}$	.0225
Diastema between $_{\overline{1}}$ and $_{\overline{2}}$, length	.0065
$_{\overline{1}}$, length	.0045
" width	.004
$_{\overline{2}}$, length	.006
" width	.008

What little remains of the skull differs hardly at all from that of *H. elongatus* except in size; the rostrum is a little shorter and wider and the preorbital fossæ rather deeper than in most individuals of the latter, but it is extremely probable that the premaxillæ were decidedly shorter. The jugal has the same general shape as in *H. elongatus*, with the usual broad, descending, suborbital plate; the posterior process is, however, quite different, being broader and more compressed, much less slender and rod-like; while the notch for the insertion of the zygomatic process of the squamosal is much better defined. The mandible is shorter and wider than in *H. elongatus* and has quite a different type of predentary beak; this beak is shorter, broader behind, narrowing forward much more rapidly, and ending in a point instead of a rounded border; the edentulous margins are much more everted or flared and the symphysis is less deeply excavated on the dorsal side. In side-view, the short beak gives to the mandible quite a different appearance. The postero-external opening of the dental canal occupies the same relative position as in *H. elongatus*.

MEASUREMENTS.

Zygomatic arch, length	.060
Skull, width over lachrymals	.045
Rostrum, width at base	.028
" " over $^{\underline{1}}$	.029
Mandible, length of predental beak	.0225
Mandible, width of predental beak in front of $_{\overline{1}}$	.021
" depth of ramus below $_{\overline{3}}$	.022
" thickness of ramus below $_{\overline{3}}$	.013

The type of *Xyophorus simus* is a similar, uncharacteristic fragment of the mandible, which, though considerably larger than that of *X. rostratus*, may very well belong to an old individual of the same species.

HAPALOPS ATLANTICUS Ameghino

Xyophorus atlanticus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 320.
Xyophorus andinus Amegh.; Ibid., p. 321.

This species, which is as yet known only from three mandibles in the Ameghino collection, differs from the preceding one principally in size, being much larger and more robust. The lower teeth are similar in character to those of *H. rostratus*, but the series varies in length from 38 to 43 mm.; the horizontal ramus is deeper dorso-ventrally and the predentary beak equally short, so that the profile of the chin rises somewhat more steeply forward. The border of the ascending ramus is more inclined backward and the postero-external opening of the dental canal is distinctly lower in position. In the largest of the three individuals the depth of the horizontal ramus below $_3$ is 30 mm.

HAPALOPS RECTANGULIDENS Ameghino.

Parhapalops rectangulidens Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 310.
Parhapalops rectangularis Amegh.; Énum. Synopt. de Mamm. Foss. de Patagonie, 1894, p. 146.
Eleutherodon heteroclitus Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 24.
? Parhapalops pygmæus Amegh.; Énum. Synopt. de Mamm. Foss. de Patagonie, 1894, p. 146.

In almost all of the species of *Hapalops* the last lower molar is of more or less distinctly cylindrical form; in the present species, however, this tooth is antero-posteriorly compressed and its principal diameter is transverse. In addition to the type in the Ameghino collection, there is in the La Plata Museum a mandible (type of *Eleutherodon heteroclitus* Mercerat) which agrees well with the type-specimen in size and in the peculiar form of $_4$, though differing very markedly in the shape of $_2$ and $_3$. The analogy of other species would indicate that the agreement in the shape of $_4$ is of greater taxonomic significance than the difference of $_2$ and $_3$. Hence, the two species should be at least provisionally united.

The first tooth ($_1$) has the usual oval cross-section and is separated from $_2$ by a short diastema. In the type $_2$ is subquadrate, while in the La Plata specimen this tooth is more antero-posteriorly compressed and transversely oval. In both individuals $_{\overline{3}}$ resembles $_{\overline{2}}$, while $_{\overline{4}}$ is transversely extended and not subcylindrical.

The mandible itself displays no important peculiarities; the predental beak most resembles that of *H. rostratus*, being short, broad at the base and tapering rapidly forward, with strongly everted or flared dorsal borders.

MEASUREMENTS.

	Type.	*La Plata Specimen.*
Lower dentition, length	.034	.0295
" " " $_{\overline{2}-\overline{4}}$	.023	.0185
$_{\overline{1}}$, length (*i. e.*, antero-posterior diameter)	.0055	.005
" width (*i. e.*, transverse diameter)	.0045	.0035
$_{\overline{2}}$, length	.007	.005
" width	.009	.008
$_{\overline{3}}$, length	.007	.005
" width	.0085	.009
$_{\overline{4}}$, length	.007	.006
" width	.0085	.008

HAPALOPS CONGERMANUS Ameghino.

Amphihapalops congermanus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 319.

Amphihapalops gallaicus Amegh.; Ibid., p. 319.

Amphihapalops cadens Amegh.; Ibid., p. 320.

This very imperfectly known species is of doubtful validity; it is of medium size and is distinguished by the elevated position of the postero-external opening of the dental canal, which is placed higher upon the ascending ramus than in any of the preceding forms. The three species which Ameghino has named do not differ from one another more than would be expected from the very different ages of the type-specimens.

Ameghino has proposed a genus, *Pseudhapalops*, which is characterized by the position of the postero-external opening of the dental canal; this foramen opens laterally, instead of anteriorly, and is situated upon the horizontal rather than the ascending ramus. Although this is a fairly constant character, with comparatively few intergradations, it does not seem to be of sufficient importance to require a generic distinction. The astragalus found with the type-specimen of *P. observationis* was evidently in only accidental association and is referable to some much smaller species, perhaps of a different genus.

HAPALOPS RUETIMEYERI Ameghino.

(Plates XXXVII, Figs. 4, 6; XXXVIII, Figs. 4, 6; XXXIX, Figs. 4, 4^a, 6, 6^a; XLII, Figs. 4–8.)

Hapalops ruthmeyeri [sic] Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 153.
Pseudhapalops rutimeyeri Amegh.; Énum. Synopt. d. Mamm. Foss. de Patagonie, 1894, p. 151.
Pseudhapalops ruetimeyeri Lydekker; Anales del Museo de La Plata, T. III, 1894, p. 101.
Pseudhapalops observationis Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 319,
Geronops circularis Amegh.; Ibid., p. 320.
Eugeronops circularis Amegh.; Ibid., p. 397.
Pseudhapalops circularis Amegh., Sec. Censo de la Repúb. Argent., T. I, 1898, p. 199.

This is a small species, considerably smaller than *H. elongatus* and differing from the latter not only in the position of the external dental foramen of the mandible, but also in several details of structure of the skull and skeleton. A finely preserved specimen, collected by Mr. Brown for the American Museum of Natural History (No. 9,250), consisting of the greater part of a skeleton, agrees so well with the type, that it may be referred to the same species, though the unfortunate absence of the mandible prevents the reference from being quite certain. As is almost invariably the case among the Santa Cruz Gravigrada, there are many individual differences between the two specimens, increased, no doubt, by their difference in age; in spite of its slightly larger size, the type is a very young animal, with widely open palatal suture, while the New York specimen is thoroughly adult. A third skull, likewise in the collection of the American Museum (No. 9,293) may be provisionally referred to the same species, though it differs in some significant respects from both of the others, and in this case also the absence of the mandible makes the reference uncertain.

The first upper tooth (1) is quite small and is placed a little farther behind the anterior edge of the palate than in *H. elongatus*. In two of the specimens this tooth has the usual bevelled crown, but in the third (No. 9,293) we find a very interesting difference, at least on the right side, the crown of the left side being broken; in the specimen in question the tooth is not bevelled and caniniform, but transversely grooved, like the molariform teeth. This is the only known instance of the kind among the Santa Cruz Gravigrada and is doubtless an individual abnormality, but it is of interest as showing how readily the caniniform may be changed into a molariform tooth, as has occurred, for example, in *Megatherium*. The diastema is of varying length, though always quite short, and the molariform teeth are transversely rectangular; $^{\underline{2}}$ is quite small, $^{\underline{3}}$ and $^{\underline{4}}$ considerably larger, and $^{\underline{5}}$ very small.

MEASUREMENTS.

	Type.	*No. 9,293.*	*No. 9,250.*
Upper dentition, length	.043	.041	.040
" " " $^{\underline{2-5}}$	.029	.027	.027
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.005	.005	.005
" width (*i. e.*, transverse diameter)	.0035	.003	.004
$^{\underline{2}}$, length	.005	.005	.0055
" width	.006	.007	.007
$^{\underline{3}}$, length	.006	.006	.0063
" width	.008	.0085	.008
$^{\underline{4}}$, length	.006	.006	.006
" width	.0075	.008	.0075
$^{\underline{5}}$, length	.003	.004	.0035
" width	.007	.006	.0065

The skull (Plates XXXVII, figs. 4, 6; XXXVIII, 4, 6; XXXIX, 4, 4^a, 6, 6^a.) has much the same general appearance as that of *H. elongatus*, but besides being smaller, differs in a number of details. The occiput is low and the cranium is moderately arched upward to the parietal eminence; the brain-case is full and broad, but the postorbital constriction is not very conspicuous, owing to the very moderate expansion of the forehead, which is but slightly convex. No sagittal crest is present, but a faintly marked sagittal area may be traced over nearly the entire length of the cranium; the area is narrowest in the frontal region, expanding posteriorly, and in one of the skulls (No. 9,250) its hinder margin curves downward and then forward, becoming continuous with the dorsal border of the zygomatic arch and thus demarcating the area of the temporal fossa in a manner which is unusual in the Santa Cruz Gravigrada, but very common among the Pleistocene genera.

Laterally, the occipital crest is quite prominent, but it dies away dorsally; the supraoccipital is reflected far over upon the dorsal side of the cranium, especially in one of the specimens (No. 9,293) in which this reflection is carried to an unusual extent; the condyles are small and nearly sessile and the paroccipital processes are obsolete. The squamosals and frontals do not differ in any important manner from those of *H. elongatus,* while the lachrymals are rather smaller and less prominent. The nasals are broad posteriorly, where their sutures with the frontals form two straight lines meeting at a very open angle; anteriorly they have blunt median points and deep lateral notches, making very long lateral processes, which project beyond the edge of the anterior nares. The premaxillaries are of the type usual in this genus, but with certain characteristic features; they are distinctly shorter and heavier than those of *H. elongatus,* the postero-external branch is heavier, the spine is more slender and the anterior branch is shorter. The maxillaries differ little from the other small species of the genus, except that they have a shorter facial portion than in *H. elongatus* and that, usually, the preorbital fossæ are narrow and shallow. The palatines are very thick and a peculiar, smooth surface slopes upward and backward from the level of the palate to the margin of the posterior nares; this surface is variable in extent and is much more distinctly shown in some individuals than in others. The hard palate is of nearly uniform width between the molariform teeth, the two series of which are almost parallel; the degree of roughness and convexity of this region varies much, perhaps according to the age of the individual. The front margin of the posterior nares is placed somewhat farther back than in most of the species.

The mandible is still incompletely known; its most characteristic feature is the position of the postero-external opening of the dental canal, which presents laterally and is placed at the base of the ascending ramus. From the length of the premaxillaries it may be inferred that the predental beak was short.

MEASUREMENTS.

	Type.	*No. 9,293.*	*No. 9,250.*
Skull, length in median line, including premaxillæ			.126
" " " " " excluding "	.105	.108	.105
" " occipital condyle to anterior nares	.124	.128	.124
" " " " to end of premaxillæ			.136
Cranium, length occipital condyle to edge of orbit	.094	.099	.094
Face, length orbit to anterior nares	.034	.031	.034

	Type.	*No. 9,293.*	*No. 9,250.*
Occiput, height		.036	.040
" width at base		.050	.051
Distance, occipital condyle to glenoid cavity	.021	.022	.023
" " " " $\underline{5}$	.062	.065	.060
Skull, width at postorbital constriction		.027	.028
" " over lachrymals		.046	.047
Zygomatic arch, length	.068	.071	.066
Palate, length in median line	.044	.043	.045
" width at $\underline{1}$	.017	.018	.016
" " " preorbital fossæ	.021	.020	.020
" " " $\underline{2}$	.010	.0125	.010
" " " $\underline{5}$	.010	.013	.011

The skeleton, which is known only from the American Museum specimen, No. 9,250, closely resembles that of *H. elongatus*, except in its distinctly smaller size. The vertebræ are somewhat smaller than in the latter, but have relatively more robust neural spines, especially in the lumbar and posterior part of the thoracic regions. In the hinder part of the thoracic region the foramina opening on the ventral side of the centra are reduced to very small proportions, in fact, almost obliterated, while in the lumbar region they remain open, reaching their maximum size in the third vertebra of this series. As in *H. elongatus*, the sacrum consists of five vertebræ, the neural spines of which are coalesced into a continuous ridge with thickened dorsal border. The caudal vertebræ are relatively somewhat heavier than in the last named species and have slightly longer and heavier transverse processes.

The comparatively unimportant differences between the vertebræ of the present species and those of *H. elongatus* may be largely due to differences of age.

MEASUREMENTS.

First thoracic, length of centrum	.018
" " width of anterior face	.014
" " " " posterior face	.015
" " " " over transverse processes	? .033
" " height of neural spine	? .031
" " width of neural spine at base	.011
Third thoracic, length of centrum	.016
" " width of anterior face	.012
" " " " posterior face	.034
Third thoracic, height of neural spine	.030
" " width of neural spine at base	.012
" " width of neural spine at tip	.010
Last thoracic, length of centrum	.022
" " width of anterior face	.024
" " " over transverse processes	.047
" " height of neural spine	.038
" " width of spine at base	.017

MEASUREMENTS.

Last thoracic, width of neural spine at tip	.019
First lumbar, length of centrum	.023
" " width of anterior face	.024
" " " " posterior face	.026
" " " over transverse processes	.049
Second lumbar, length of centrum	.025
" " width of anterior face	.025
" " " " posterior face	.026
" " " over transverse processes	.046
Third lumbar, length of centrum	.026
" " width of anterior face	.026
" " width over transverse processes	.048
" " height of neural spine	.039
Fourth lumbar, length of centrum	.026
" " width of anterior face	.027
" " " over transverse processes	.054
" " height of neural spine	.040
Sacrum, length	.119
First sacral, width of anterior face	.030
Fourth sacral, width of posterior face	.027
First caudal, length	.022
First caudal, width of anterior face	.030
" " " over transverse processes	.085
Second caudal, length of centrum	.022
" " width of anterior face	.026
" " " over transverse processes	.081
Third caudal, length of centrum	.022
" " width of anterior face	.026
" " " over transverse processes	.076
Fourth caudal, length of centrum	.022
" " width of anterior face	.022
" " " over transverse processes	.068
Fifth caudal, length	.022
" " width of anterior face	.021
" " over transverse processes	.068
Sixth caudal, length	.023
" " width of anterior face	.020
" " " over transverse processes	.063
Seventh caudal, length	.022
" " width of anterior face	.018
" " " over transverse processes	.059

In the humerus (Plate XLII, fig. 4), the differences from *H. elongatus* are but trifling; although this bone is actually shorter than in the latter species, its relative length, as compared with that of the skull, is nearly the same, and the proximal portion is somewhat heavier; the bicipital groove is rather more distinctly marked and the inner border of the deltoid area is extended proximally almost to the head, not dying away so gradually as in the other species. The supinator ridge is hardly so broad as in *H. elongatus*, but has a thicker free border and the trochlear facet for the radius is somewhat less convex; the supratrochlear fossa is decidedly smaller and shallower and the anconeal fossa very much more so.

The fore-arm bones (Plate XLII, figs. 5, 6) also differ very little save in size from those of *H. elongatus;* the ulna is somewhat more curved in both directions, especially laterally, while the radius has a somewhat larger proximal facet for the ulna and a less prominent bicipital tubercle, and the inner border of the distal half of the radial shaft is somewhat more distinct.

Measurements.

Humerus, length	.129	Ulna, width at sigmoid notch	.0195
" width of proximal end	.037	" " of distal end	.010
" " " trochlea	.027	Radius, length	.111
" " over epicondyles	.050	" width of proximal end	.019
Ulna, length	.128	" " " distal end	.023
" " of olecranon	.020	" greatest width of shaft	.020

The pelvis (see text-figure 21, p. 170) is very similar to that of *H. elongatus*, with a few differences. The ilium is somewhat more everted, making the acetabular border more concave, and has a more curved crista; the acetabulum is smaller and more circular and the fossa for the round ligament is less extensive; the obturator foramen is of a different shape, the dorso-ventral diameter being greater and the antero-posterior diameter less; the descending process of the ischium, behind the obturator foramen, is more slender and the symphysis appears to be somewhat shorter.

Measurements.

Pelvis, length	.190	Acetabulum, antero-posterior diameter	.032
" greatest width	.225	" dorso-ventral diameter	.027
Ilium, length	.114	Ischium, length	.076
" greatest width	.080	Symphysis, length	.039

In the femur (Plate XLII, fig. 7) the head is more oblique, directed more proximally and rising higher above the level of the great trochanter than in *H. elongatus;* the pit for the round ligament is smaller and shallower; the second trochanter is rather more prominent and the third trochanter broader proximo-distally; the condyles are of similar shape, but even less prominent, so that the notch between them is smaller.

The tibia (Plate XLII, fig. 8) is almost a copy of that of *H. elongatus*, on a somewhat reduced scale; the facets for the femoral condyles are a little more closely approximated and the spine slightly more pronounced, while the cnemial process is even more reduced. The shaft and distal end differ in no significant way, but the postero-internal margin of the astragalar facet is more prominent and the intercondylar ridge less so.

The fibula (Plate XLII, fig. 8) differs from that of *H. elongatus* rather more than does the tibia; the proximal end is thicker antero-posteriorly and the shaft is more slender; the distal facet for the tibia is smaller and that for the astragalus more nearly plane.

The astragalus is less grooved than in the last named species, which is due principally to the smaller development of the inner condyle; the neck is distinctly shorter and the internal calcaneal facet is smaller and somewhat better demarcated from the navicular facet on the plantar side of the neck.

MEASUREMENTS.

Femur, length from head	.150
" " " great trochanter	.150
" width of proximal end	.056
" " " distal end over tuberosities	.048
" " " " " " condyles	.045
Tibia, length	.119
" width of proximal end	.046
" thickness of proximal end	.035
" width of shaft in middle	.018
" thickness of shaft in middle	.012
Tibia, thickness of distal end	.020
Fibula, length	.109
" width of proximal end	.014
" thickness of proximal end	.017
" width of shaft in middle	.007
" thickness of shaft in middle	.009
" width of distal end	.020
" thickness of distal end	.018
Astragalus, length	.029
" width of trochlea	.020
" " " distal end	.015

HAPALOPS GRACILIDENS Ameghino.

(Plates XLIV, Figs. 2, 2^a, 2^b, 2^c; XLV, Fig. 4.)

Hapalops gracilidens Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 317.

In the Princeton collection, this species is represented by two skulls, without mandibles, which were found by Mr. Hatcher, one (No. 15,529) at Killik Aike, and the other (No. 15,525) at Lake Pueyrredon; the latter has been considerably distorted by lateral pressure, which much exaggerates the difference between the two specimens.

The teeth are strikingly small even in proportion to the small size of the skull, and this is especially true of the individual from Lake Pueyrredon. The first upper tooth ($\frac{1}{}$) is subcylindrical and relatively large, its alveolus forming quite a prominence upon the side of the face; the diastema is short and the molariform teeth ($\frac{2-5}{}$) are of transversely rectangular shape; $\frac{3}{}$ is slightly larger than the others, while $\frac{5}{}$ is extremely small, particularly so in the type. The teeth of the two sides form parallel rows.

MEASUREMENTS.

	Type.	*No. 15,525.*	*No. 15,529.*
Upper dentition, length			.037
" " " $\underline{2}$–$\underline{5}$	.023	.022	.0235
$\underline{1}$, length (*i. e.*, antero-posterior diameter)			.006
" width (*i. e.*, transverse diameter)			.004
$\underline{2}$, length		.005	.005
" width		.006	.0055
$\underline{3}$, length		.0055	.0055
" width		.0065	.007
$\underline{4}$, length		.0045	.005
" width		.006	.0065
$\underline{5}$, length		.003	.0035
" width	.004	.005	.005

In appearance and proportions the skull is one of the most peculiar to be found in the present genus and the peculiarities are best displayed in the Killik Aike specimen (No. 15,529), (Plate XLIV, fig. 2). The occiput is both broad and high and the cranium is strongly vaulted; from the parietal eminence, which is longer than usual and extends forward to the frontal suture, there is a steep descent forward to the forehead and thence a very slight descent to the end of the rostrum; the contrast in dorso-ventral height between the cranial and facial regions is thus very marked. An occipital crest can hardly be said to exist, and the sagittal crest is either entirely absent (No. 15,525) or very feebly indicated on the frontals only (No. 15,529), in which case it is associated with a sagittal area on the parietals; the supraoccipital is very extensively reflected over upon the dorsal surface of the cranium, especially in the Lake Pueyrredon specimen. The parietals form more of the cranial walls than usual, while the squamosals are relatively small; the frontals have less of an hour-glass shape than in most species of the genus, for the expansion in front of the post-orbital constriction is slight and very gradual. The maxillaries have no especially characteristic features except the small size of the preorbital fossæ and the flatness of the palate.

MEASUREMENTS.

	No. 15,525.	*No. 15,529.*
Skull, length from foramen magnum to anterior nares		?.106
Cranium, length from foramen magnum to edge of orbit	.087	.084
Face, length orbit to anterior nares		?.022
Occiput, height	.036	.032
" width at base	.043	043

MEASUREMENTS.

	No. 15,525	*No. 15,529*
Skull, width at postorbital constriction	.026	.029
“ “ over lachrymals		.041
Zygomatic arch, length	.055	.054
Palate, width at $\underline{1}$		.012
“ “ “ preorbital fossæ		.018
“ “ “ $\underline{2}$	.011	.012
“ “ “ $\underline{5}$	.011	.011

HAPALOPS FORTICULUS Ameghino.

Pseudhapalops forticulus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 319.

Pseudhapalops altiramis Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 150.

The most characteristic feature of this species is to be found in the shape of the lower caniniform tooth ($\overline{1}$) which is large and laterally compressed and projects from the side of the jaw almost as much as in some of the species of *Eucholœops*. The mandible has an extremely short predental beak and the profile of the chin curves uninterruptedly into the ventral border of the horizontal ramus, the two together describing a considerable segment of a circle. The postero-external dental foramen is large and opens laterally, not anteriorly, and is placed in an unusually inferior position, upon the side of the horizontal ramus below the base of the coronoid.

In the collection of the La Plata Museum is a portion of the lower jaw which agrees quite exactly with the type of the present species.

The specimen to which Ameghino has given the name *Pseudhapalops altiramis* (*loc. cit.*, p. 150) appears to be merely a more robust and older individual of the present species, with lower caniniform of more triangular and less laterally compressed shape.

MEASUREMENTS.

	Type.	*P. altiramis.*
Lower dentition, length	.039	.037
“ “ “ $\overline{2}$–$\overline{4}$	.022	.023
$\overline{1}$, length (*i. e.*, antero-posterior diameter)	.007	.007
“ width (*i. e.*, transverse diameter)		.005
$\overline{2}$, length	.0065	.006
$\overline{3}$, length	.006	.006
“ width	.009	

MEASUREMENTS.

	Type.	*P. altiramis.*
$\overline{4}$, length	.008	
" width	.010	
Depth of jaw at $\overline{3}$	.025	.025

HAPALOPS GRANDIS Ameghino.

Pseudhapalops grandis Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 151.

This appears to be a fairly well characterized species, despite its variability in certain respects; it resembles the preceding one in the form of the jaw, but is very much larger. The species is represented by three specimens in the Ameghino collection and by a fourth in the La Plata Museum. In the type $\overline{1}$ is of moderate size, in a second individual it is smaller and more cylindrical, and in a third it is much compressed, the cross-section suggesting the canine of a small machairodont. The predental beak of the mandible is longer than in *H. forticulus*, but otherwise the shape of the jaw and the position of the postero-external dental foramen are much as in the latter.

MEASUREMENTS.

Lower dentition, length	.045	Mandible, length from condyle	.120
" " " $\overline{2}$–$\overline{4}$	.029	" " of predental beak	.032
$\overline{1}$ length (*i. e.*, antero-posterior diameter)	.006	" depth below $\overline{2}$	.033
" width (*i. e.*, transverse diameter)	.005		

HAPALOPS LONGITUDINALIS Ameghino.

Pseudhapalops longitudinalis Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 319.

Although known only from a single fragment of the lower jaw, this is probably a valid species, unless it should prove to be merely an individual abnormality. It is characterized by the very exceptional shape of $\overline{1}$, which, instead of being cylindrical or transverse, as it is in all of the other known species of the genus, is elliptical with the major axis in the antero-posterior direction.

MEASUREMENTS.

Lower dentition, length $\overline{2}$–$\overline{4}$	.0245	$\overline{3}$, width	.008
$\overline{2}$, length (*i. e.*, antero-posterior diameter)	.007	$\overline{4}$, length	.008
$\overline{2}$, width (*i. e.*, transverse diameter)	.0085	" width	.006
$\overline{3}$, length	.0065	Depth of jaw below $\overline{3}$	.024

The skulls of Gravigrada, six in number, which Mr. Hatcher collected at Lake Pueyrredon, appear with one exception, to belong to species different from those which have been found on or near the Atlantic coast. The specimens, all of which are in a hard concretionary matrix, are not in a very satisfactory state of preservation and have suffered more or less distortion from pressure. No two individuals are alike and, in the absence of much more extensive materials, it is extremely difficult to determine how many species are represented. The exception noted above is a small skull (No. 15,525) which agrees very well with *H. gracilidens* from the coast region. Of the others, one is a very well marked species and is described below as *H. vulpiceps*, and the remaining four may be provisionally assigned to one species, *H. platycephalus*, for, though they are quite dissimilar in size and appearance, these dissimilarities are evidently in part due to differences of age, in part to the varying direction and amount of the pressure to which they have been subjected; the remaining differences should probably be ascribed to the variability which is so striking in the entire group.

HAPALOPS VULPICEPS sp. nov.

(Plate XLIV, Figs. 1, 1*a*, 1*b*.)

In the proportions of the skull this species differs notably from all other known Santa Cruz Gravigrada, rather resembling, especially in side-view, the skull of a carnivore. Of the dentition, the upper series is represented by $^{\underline{1}}$, broken to the level of the jaw, $^{\underline{2}}$ and $^{\underline{5}}$ intact and the empty alveoli of $^{\underline{3}}$ and $^{\underline{4}}$; all the lower teeth are preserved in a more or less broken condition.

The upper caniniform ($^{\underline{1}}$) is relatively large and, though separated from $^{\underline{2}}$ by a considerable diastema, is yet implanted unusually far behind the anterior end of the palate, farther than in any other species of the genus; in cross section this tooth is a longitudinal, much compressed oval; $^{\underline{2}}$ is relatively small and of transversely oval form; $^{\underline{3}}$ and $^{\underline{4}}$, which were evidently much larger than $^{\underline{2}}$, were apparently of almost equal size, and $^{\underline{5}}$ is small and much compressed antero-posteriorly. In the mandible $_{\overline{1}}$ is small, obscurely trihedral, with two faint vertical grooves, which demarcate an external pillar; $_{\overline{2}}$ and $_{\overline{3}}$ are quite large and transversely rectangular, while $_{\overline{4}}$ has the usual subcylindrical shape.

MEASUREMENTS.

Upper dentition, length	.0425	^{5}, width	.006
" " " $^{2-5}$	.025	Lower dentition, length	.0335
^{1}, length (*i. e.*, antero-posterior diameter)	.0075	" " " $_{2-4}$	.023
" width (*i. e.*, transverse diameter)	.004	$_{1}$, length	.0045
^{2}, length	.005	" width	.004
" width	.007	$_{2}$, length	.0065
^{3}, length	.007	" width	.008
" width	.0085	$_{3}$, length	.0065
^{4}, length	.007	" width	.008
" width	.008	$_{4}$, length	.007
^{5}, length	.003	" width	.007

As already remarked, the skull has a highly characteristic appearance. The cranium is long, broad and quite low, the upper contour rising but slightly from the summit of the occiput to the inconspicuous parietal eminence; the postorbital constriction is long, but not deep, the forehead is gently convex and the preorbital region, or rostrum, unusually long, narrow and tapering. It is this elongate, tapering rostrum which, more than any other feature, gives its peculiar appearance to the skull. The sagittal crest is feebly developed and only upon the frontals in the region of the postorbital constriction. The occiput is low and broad, somewhat inclined forward, and decidedly convex in both directions, with a median prominence which lodges the vermis; the condyles are quite large and prominent, but the paroccipital processes appear to be entirely obsolete. In marked contrast to nearly all the other species of *Hapalops*, the supraoccipital is hardly at all reflected upon the dorsal side of the cranium. The parietals, which are large, have no sagittal crest, but, on the contrary, a well defined groove along the sagittal suture, and an ill-defined sagittal area, which is broadest in the middle and narrows both before and behind. The zygomatic process of the squamosal is much swollen at the base, indicating an unusually large sinus. The tympanics, frontals and lachrymals do not differ in any significant way from those of the other species of the genus. The nasals are narrow and elongate; they are broadest at the frontal suture and narrowest about the middle of their course, expanding again at the anterior end, where they show the usual lateral notches. The maxillaries have an elongate facial portion, in front of the orbits, and the preorbital fossæ are very shallow; the hard palate is moderately convex and of uniform width between the molariform teeth, while the anterior part is flat and relatively narrow, in correspondence with the slenderness of the rostrum.

The mandible, which is represented only by the horizontal rami, lacking the predental beak, is characterized by the external dental foramen, which presents laterally rather than anteriorly and is placed at the base of the coronoid process, somewhat more elevated than in *H. forticulus* and lower down than in most species of the genus.

MEASUREMENTS.

Skull, length in median basal line	.109
" " occipital condyle to anterior nares	.127
Cranium, length condyle to edge of orbit	.095
Face, length orbit to anterior nares	.032
Occiput, height	.036
" width at base	.050
Skull, width at postorbital constriction	.030
" " over lachrymals	.044
Zygomatic arch, length	.065
Distance occipital condyle to glenoid cavity	.021
" " " " $\underline{5}$	.062
Palate, length in median line	.046
" width at $\underline{1}$	.016
" " " preorbital fossæ	.018
" " " $\underline{2}$	.010
" " " $\underline{5}$	.011
Mandible, depth below $\overline{3}$	.023
" thickness below $\overline{3}$	.013

HAPALOPS PLATYCEPHALUS sp. nov.

(Plate XLV, Figs. 1–3^a.)

As the type of this species No. 15,564 will be taken, for that is the most mature and best preserved individual of the series, although it has suffered from oblique distortion. *H. platycephalus* is one of the smaller species of the genus, about equalling *H. elongatus* in size, but decidedly more robust; it may be recognized by the short diastema between $\underline{1}$ and $\underline{2}$, the unusually flat palate, the short, wide rostrum, with deep preorbital fossæ, the broad, depressed cranium, without sagittal crest, and the low, wide occiput, with very inconspicuous occipital crest.

The teeth are of the pattern common throughout the genus; $\underline{1}$ is not preserved in any of the specimens, but the alveolus shows that it was small and longitudinally oval; this tooth appears to have been inserted well behind the anterior edge of the palate, but the broken condition of all the skulls renders this somewhat uncertain. After a rather short diastema follows $\underline{2}$, which is ordinarily quite small and transversely rectangular; $\underline{3}$ is the largest of the series and $\underline{4}$ is slightly larger than $\underline{2}$; $\underline{5}$ is much reduced. The lower teeth, which are preserved only in the type, have no striking peculiarities.

MEASUREMENTS.

	No. 15,564.	*No. 15,534.*	*No. 15,522.*
Upper dentition, length	.044		
" " " $\underline{2}-\underline{5}$	.026	.025	.026
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.007		
" width (*i. e.*, transverse diameter)	.0065		
$\underline{2}$, length	.0055	.005	.0055
" width	.007	.0065	.008
$\underline{3}$, length	.006	.006	.005
" width	.0085	.008	.0085
$\underline{4}$, length	.005	.005	.005
" width	.008	.008	.007
$\underline{5}$, length	.003	.0035	.004
" width	.006	.006	.007

The following measurements are from the type-specimen, No. 15,564.

Lower dentition, length	.036
" " " $\overline{2}-\overline{4}$	.022
$\overline{1}$, length	.006
" width	.005
$\overline{2}$, length	.0053
$\overline{2}$, width	.008
$\overline{3}$, length	.006
" width	.008
$\overline{4}$, length	.0075
" width	.007

The general characters of the skull have been given in the diagnosis of the species and it remains only to mention some of the more important details. The occiput is unusually low and wide, and is nearly vertical, with a broad median convexity, which is especially distinct in the fully mature individual; near the dorsal border of this convexity appears a median ridge, which extends for a short distance upon the dorsal side of the cranium; the foramen magnum is small, as are also the nearly sessile condyles; no paroccipital processes are apparent.

The occipital crest is weakly developed, dying away dorsally, but becomes more distinct with age; the supraoccipital is reflected upon the dorsal side of the cranium to an unusual degree, much less, however, in No. 15,522, which is the most aberrant of the series and may pertain to another species. The broad, vaulted parietals show no trace of a sagittal crest and only an obscurely indicated sagittal area. The forehead is broad and nearly flat and the postorbital constriction is very shallow; the sagittal crest is absent from the frontals of all but the oldest individual, in which it is feebly developed. The nasals are very wide, especially at the hinder end, where they describe the segment of a circle, quite deeply emarginating the frontals. The preorbital fossæ are shallow, except in No. 15,522, in which they are well defined.

Of the mandible only a fragment of the left ramus, belonging to the type, is preserved; it seems to be of more uniform dorso-ventral depth and to be less thickened in the dentary region than is usual in this genus.

In the following measurements it should be observed that the type-specimen (No. 15,564) has been made unduly low and wide by crushing.

MEASUREMENTS.

	No. 15,564.	*No. 15,534.*	*No. 15,522.*
Cranium, length occipital condyle to edge of orbit	.108	.096	.101
Occiput, height	.035	.034	.036
" width at base	.055	.049	.050
Cranium, width at postorbital constriction	.036	.030	.030
" " over lachrymals	.060		
Zygomatic arch, length	.075	.064	.070
Distance, occipital condyle to glenoid cavity	.027	.026	
" " " " $\underline{5}$	.071	.065	
Palate, width at $\underline{1}$	.020		.022
" " " preorbital fossæ	.023	.019	.020
" " " $\underline{2}$	.014	.011	.0125
" " " $\underline{5}$	.013	.010	.013
Mandible, depth below $\overline{3}$	.023		
" thickness below $\overline{3}$.	.013		

Associated with the type are a number of fragmentary vertebræ and of limb-bones in better preservation. The latter are of about the same length as in *H. elongatus*, but considerably stouter. The humerus is quite robust, with more prominent deltoid ridge than in the last named species, larger epicondylar foramen and much shallower supratrochlear fossa. The femur differs from that of *H. elongatus* in only a few particulars; the head is larger, the neck less distinct, the great trochanter smaller and the digital fossa even shallower; the second trochanter is rather more prominent and the third broader proximo-distally; the shaft is broader and the rotular groove and intercondylar notch are wider. The tibia is somewhat heavier and more curved.

MEASUREMENTS.

Humerus, length	.152	Humerus, width of trochlea	.031
" width of proximal end	.039	Femur, length from head	.168
" " " shaft below deltoid area	.020	" " " great trochanter	.161
		" width of proximal end	.063

MEASUREMENTS.

Femur, width of distal end over condyles	.049	Tibia, thickness of proximal end	.040
" " " rotular groove	.025	" width of shaft in middle	.020
Tibia, length	.123	" thickness of shaft in middle	.015
" width of proximal end	.050	" " " distal end	.022

In addition to the foregoing species of *Hapalops*, which may be regarded as more or less well defined, several species have been named, concerning which I could arrive at no definite conclusion, either because, at the time of my visit to La Plata, the types were inaccessible, or because the material was insufficient for determination. In the following list of these supposed species they are all referred to *Hapalops*, though some of them may prove to belong to different genera.

HAPALOPS ADTEGER Ameghino.

Eucholœops adteger Amegh.; Enumeracion sistematica, etc., 1887, p. 23.
Eucholœops adteger Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent., 1889, p. 694.
Hapalops adteger Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 317.
Eurysodon adteger Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 20.
Hapalops adteger Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 145.
Hapalops adteger Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 198.

HAPALOPS CRASSIDENS Ameghino.

Hapalops crassidens Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 136.
Hapalops crassidens Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonia; 1894, p. 146.
Hapalops crassidens Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 198.

HAPALOPS DIVERSIDENS Ameghino.

Hapalops diversidens Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 317.

Hapalops diversidens Amegh. ; Énum. Synopt. des Mamm. Foss. de Patagonie ; 1894, p. 145.
Hapalops diversidens Amegh. ; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 198.

HAPALOPS LONGIPALATUS Ameghino.

Hapalops longipalatus Amegh. ; Rev. Argent. de Hist. Nat., T. I, 1891, p. 317.
Hapalops longipalatus Amegh. ; Énum. Synopt. des Mamm. Foss. de Patagonie ; 1894, p. 145.
Hapalops longipalatus Amegh. ; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 198.

HAPALOPS DEPRESSIPALATUS Ameghino.

Hapalops depressipalatus Amegh. ; Rev. Argent. de Hist. Nat., T. I, 1891, p. 317.
Hapalops depressipalatus Amegh. ; Énum, Synop. des Mamm. Foss. de Patagonie ; 1894, p. 146.
Hapalops depressipalatus Amegh. ; Sec. Censo de la Repúb. Argent. T. I., 1898, p. 198.

HAPALOPS TESTUDINATUS Ameghino.

Hapalops testudinatus Amegh. ; Rev. Argent. de Hist. Nat., T. I, 1891, p. 318.
Hapalops testudinatus Amegh. ; Énum. Synopt. des Mamm. Foss. de Patagonie ; 1894, p. 146.
Hapalops testudinatus Amegh. ; Sec. Censo. de la Repúb. Argent., T. I, 1898, p. 198.

HAPALOPS CRASSIGNATHUS Ameghino.

Hapalops crassignathus Amegh. ; Rev. Argent. de Hist. Nat., T. I, 1891, p. 318.
Hapalops macrognathus Amegh. ; Énum. Synopt. des Mamm. Foss. de Patagonie ; 1894, p. 145.
Hapalops macrognathus Amegh. ; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 198.

HAPALOPS MINUTUS Ameghino.

Hapalops minutus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 318.
Hapalops minutus Amegh.; Énum. Synopt. de Mamm. Foss. de Patagonie; 1894, p. 146.
Hapalops minutus Amegh.; Sec. Censo de la Repub. Argent.; T. I, 1898, p. 198.

HAPALOPS AUSTRALIS (Mercerat).

Stenocephalus australis Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 10.
Hapalops indifferens Amegh., in part; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 145.

HAPALOPS COGNATUS (Mercerat).

Stenocephalus cognatus Mercerat; Rev. del Mus. de La Plata; T. II, 1891, p. 11.
Hapalops rectangularis Amegh., in part; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 144.

HAPALOPS BOULEI (Mercerat).

Eurysodon boulei Mercerat; Rev. del Mus. de La Plata; T. II, 1891, p. 21.
Xyophorus sulcatus Amegh., in part; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 155.

HAPALOPS ROSTRATUS (Mercerat non Ameghino).

Eurysodon rostratus Mercerat; Rev. del Mus. de La Plata; T. II, 1891, p. 22.

HAPALOPS LATUS (Ameghino).

Amarorhynchus latus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 147.
Amarorhynchus latus Amegh.; Sec. Censo de la Repúb. Argent.; T. I, 1898, p. 199.

HAPALOPS CRASSISSIMUS (Ameghino).

Xyophorus crassissimus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 156.
Xyophorus crassissimus Amegh.; Sec. Censo de la Repúb. Argent., T. I., 1898, p. 200.

HAPALOPS PRIMUS (Ameghino).

Mecorhinus primus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 157.

Mechorhinus primus Amegh.; Sec. Censo de la Repúb. Argent.; T. I, 1898, p. 200.

It may seem quite incredible that so many as twenty-two species of a single genus should have coexisted in the same region, but there are many independent reasons for believing that they did not all exist at the same time. A more minute study of the Santa Cruz beds than has yet been practicable will very probably demonstrate their divisibility into several zones, each characterized by its own species. Further, it should be remembered that the twenty-two species of *Hapalops* admitted in the preceding pages are of a very provisional character, and that more extensive and better preserved material may necessitate the union of many of these so-called species. Even with that now at command, it is obvious that there are several groups of species, the members of each group or series being more nearly connected with one another than with those of other groups. One such series, characterized by broad cranium and rostrum, elongate premaxillaries and predentary beak of the mandible, is composed of *H. rectangularis*, *indifferens*, *longiceps*, *robustus*, *aguirrei* and *brachycephalus;* a second series, with long and narrow skull, short premaxillæ and mandibular beak, is made up of *H. elongatus*, *rostratus*, *atlanticus*, *ruetimeyeri*, *gracilidens*, and *angustipalatus* and other similar series might be readily constructed. It is not at all impossible that it may become necessary to unite these twelve supposed species into two, and yet this is not likely, both on account of the stratigraphic reasons, and because of the great differences of size which such a fusion would involve. Decide these questions as we may, the variability of the species of this genus is most surprising.

HYPERLEPTUS Ameghino.

(Plate LIV, figs. 1, 1ᵃ)

Hyperleptus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 155.

? Eucholœops Amegh., in part; Ibid., p. 323.

Hyperleptus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 151.

? Pseudhapalops Lydekker, in part; Anales del Mus. de La Plata; T. III, 1894, p. 100.

This genus is very closely allied to *Hapalops* and should perhaps be united with it; for the present, however, it will be preferable to keep it distinct, because of the lack of transitional specimens. The only diagnostic character of *Hyperleptus* is the peculiar shape of the premaxillæ, which form short, broad, triangular plates, with the apex directed forward; the change is due to the relatively great broadening of the postero-external branch of each premaxillary, whereby the incisive foramina are reduced to very narrow slits; the surfaces on the maxillaries for articulation with the premaxillæ are also characteristic. The preorbital fossæ are very deep, producing a marked constriction of the palate at the diastema between $\frac{1}{}$ and $\frac{2}{}$, while the alveoli of the upper caniniform teeth are so prominent as to produce a strikingly broad muzzle, much as in *Eucholœops.* The postero-external opening of the dental canal (external dental foramen) is on the horizontal ramus at the base of the coronoid.

HYPERLEPTUS GARZONIANUS Ameghino.

(Plate LIV, Figs. 1, 1*a*.)

Hyperleptus garzonianus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 155.

? Eucholœops fissognathus Amegh.; Ibid. p. 323.

? Hyperleptus schissognathus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 152.

? Eucholœops litoralis Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 322.

? Hyperleptus litoralis Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 152.

? Pseudhapalops ruetimeyeri Lydekker, in part; Anales des Mus. de La Plata, T. III, 1894, p. 101.

The type-specimen in the Ameghino collection has been considerably altered in appearance by lateral compression, which renders the skull unduly narrow and exaggerates the apparent development of the sagittal crest.

The teeth display but few differences from those of *Hapalops;* the upper caniniform ($\frac{1}{}$) is of moderate size and subcylindrical shape; it is implanted a very short distance behind the anterior border of the maxillary and its external face projects well outside the line of the other teeth, almost as much as in *Eucholœops.* The diastema between $^{\underline{1}}$ and $^{\underline{2}}$ is longer than in most species of *Hapalops.* Of the molariform teeth, $^{\underline{2}}$, $^{\underline{3}}$ and $^{\underline{4}}$ are transversely oval, differing only in size, $^{\underline{3}}$ being the broadest transversely and shortest antero-posteriorly; $^{\underline{5}}$ is nearly cylindrical, which is a very unusual feature, though materials are lacking to determine whether this is an individual abnormality, or whether it is truly characteristic of the species.

In the mandibular dentition the resemblance to *Hapalops* is even closer; $_{\overline{1}}$ is high, erect and bevelled by attrition and the diastema is quite short, much shorter than in the upper jaw; $_{\overline{2}}$ and $_{\overline{3}}$ are transversely oval and $_{\overline{4}}$, which is unusually large, is of the ordinary, subcylindrical shape.

MEASUREMENTS.

Upper dentition, length	.067
" " " $^{\underline{2-5}}$	.039
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.009
" width (*i. e.*, transverse diameter)	.007
$^{\underline{2}}$, length	.0085
" width	.012
$^{\underline{3}}$, length	.008
" width	.0135
$^{\underline{4}}$, length	.0085
" width	.012
$^{\underline{5}}$ length,	.0075
$_{\overline{5}}$, width	.009
Lower dentition, length	.048
" " " $_{\overline{2-4}}$	.030
$_{\overline{1}}$, length	.007
" width	.006
$_{\overline{2}}$, length	.008
" width	.012
$_{\overline{3}}$, length	.008
" width	.012
$_{\overline{4}}$, length	.010
" width	.0095

The skull resembles that of *Hapalops* and, in a somewhat less pronounced degree, that of *Eucholœops.* The occiput is quite high in proportion to its width and the supraoccipital does not extend at all upon the dorsal side of the cranium; the upper contour of the skull rises very gently from the occipital crest to the parietal eminence, which is inconspicuous; from that point it pursues a nearly horizontal course to the fronto-nasal suture, whence it descends very gradually to the muzzle. Occipital and sagittal crests are present, but are not very prominent and the latter ends upon the frontals by dividing into two very obscurely marked temporal ridges. The preorbital or facial region is relatively long and high and the preorbital fossæ of the maxillaries are very deep on the ventral side, where they notably constrict the palate, but become very shallow dorsally, so that they are hardly visible from above. The nasals are quite long and broaden anteriorly, where they are curved downward at the sides and abruptly truncated, except that each has a broad and very shallow notch, entirely different from the deep and narrow lateral notches of *Hapalops*. The premaxillæ are short, broad behind, narrowing forward and ending in a blunt point; together they form a broad, heavy, triangular and almost solid plate of bone, the incisive foramina being reduced to narrow slits. The premaxillary facets on the maxillaries are equally characteristic; that for the postero-external branch occupies nearly the entire width of each maxillary, while the median notch of the palate which receives the premaxillary spines is very narrow and shallow, quite unlike that seen in any other genus. The zygomatic arch does not differ in any important respect from that of *Hapalops* and the jugal, with its long suborbital process, is quite as in that genus.

The mandible has a rather elongate horizontal ramus, the ventral border of which is but slightly convex, in marked distinction from that of *Hapalops*, and the concavity beneath the ascending ramus is correspondingly slight. The symphysis is short and the profile of the chin is thus quite steep; nevertheless, the predental beak is quite elongate and contracts anteriorly to a rounded edge, which is notched in the median line.

MEASUREMENTS.

Skull, median basal length, including premaxillary	.200
" " " " excluding premaxillary	.186
Palate, width at $\underline{1}$	.025
Palate, width at $\underline{2}$	.017
" " " $\underline{5}$	.014
Mandible, length of predental beak	.040
" depth below $\overline{3}$	.036
" thickness below $\overline{3}$	.029

HYPERLEPTUS SECTUS Ameghino.

Hyperleptus sectus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 155.

This species is closely allied to the preceding one and may prove to be identical with it. It is distinguished by the form of the last upper tooth, $\underline{5}$, which is transverse and not subcylindrical, and by the much more decided constriction of the palate. The very broad muzzle, with its projecting caniniform teeth, emphasizes the likeness to *Eucholœops*. The premaxillaries are not known, but the facets for them upon the maxillaries are quite as in *H. garzonianus*.

The following measurements are from the type-specimen in the Ameghino collection.

Measurements.

Upper dentition, length	.069	$\underline{4}$, length	.008
" " " $\underline{2}$–$\underline{5}$	.038	" width	.012
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.008	$\underline{5}$, length	.006
" width (*i. e.*, transverse diameter)	.006	" width	.010
$\underline{2}$, length	.009	Palate width at $\underline{1}$	.025
" width	.012	" " " $\underline{2}$	.015
$\underline{3}$, length	.0085	" " " $\underline{5}$	.014
" width	.013	Muzzle, width over $\underline{1}$	.042

EUCHOLŒOPS Ameghino.

(Plates LV–LVII.)

Eucholœops Amegh.; Enumeracion sistematica, etc., 1887, p. 21.

This genus is nearly allied to *Hapalops*, which it resembles in all parts of the skeleton, the constant differences between the two genera being almost confined to the dentition and skull. Specimens of *Eucholœops* are very much less common in the Santa Cruz beds than those of *Hapalops* and there is no such abundance of species as in the latter, but we meet with the same variability and the same difficulty in making any satisfactory systematic arrangement.

In the dentition, the characteristic feature of the genus is to be found in the first tooth of each jaw, which is large, prominent and caniniform, usually pointed by abrasion and placed externally to the line of the other teeth. Some individuals show signs of what may be sexual differences in the size of these teeth, which are considerably larger in certain specimens than in others which differ from the former in no other respect; $\underline{1}$ is implanted close to the anterior border of the maxillary and is always followed by a relatively long diastema. The molariform teeth resemble those of *Hapalops* in shape, being transversely oval or obscurely rectangular and grooved by a deep valley.

The skull has a similar general appearance to that of *Hapalops*, but with a number of constant and characteristic differences; it is shorter in proportion and quite conspicuously broad and heavy; the sagittal and occipital crests are much better developed and in some of the species are very prominent, less so in others, and the supraoccipital is little or not at all reflected over upon the dorsal side of the cranium. The muzzle is very broad, expanding anteriorly and, except for the premaxillæ, abruptly truncated; the facial portion of the maxillary is not continued in front of the caniniform tooth, as it is in almost all other Gravigrada of the Santa Cruz, but forms a rounded, massive, pillar-like alveolus for this tooth in a highly characteristic manner; the preorbital fossæ are broad and on the ventral side are very deep, but they do not extend to the dorsal side of the rostrum and hence the constriction is much more striking when the skull is seen from below.

The mandible is very characteristic; the horizontal ramus is short and deep, very thick and massive and usually the alveolus of the caniniform projects outward as a prominent pillar; in front of this pillar is a deep notch, which receives the upper caniniform; the predental beak is very short, but narrowing forward rapidly and terminating in a blunt point; however, there is considerable variation in the shape of this beak, even in the same species; it is depressed and but little excavated upon the dorsal side and, in correlation with its shape, the symphysis is short and steep. The ascending ramus is relatively better developed than in *Hapalops* and the coronoid and angular processes are larger; the postero-external opening of the dental canal is at the base of the coronoid upon the horizontal ramus, the usual position among the Santa Cruz Gravigrada, except in most of the species of *Hapalops*.

So far as it is known, the skeleton agrees very well with that of *Hapalops*, differing only in details of minor importance. As the known parts of the skeleton almost all belong to *E. fronto*, they will be described in connection with that species.

From the material that has been collected it is impossible to reach any very definite conclusions as to the number of species into which *Eucholœops* should be divided. Lydekker ('94, 95) recognizes but one species[1] of this genus, while Ameghino has described six, to which Mercerat has added two. Of these, two are quite distinct, a larger one, *E. ingens*, and a smaller one, *E. fronto;* a third species, *E. externus*, would undoubtedly be recognized as valid, if we could be assured that the type and only known specimen were normal. Probably a fourth species, *E. curtus*, also known only from the type, should be accepted, though additional material is necessary to determine this point with certainty.

The relationships of *Eucholœops* are not obscure; obviously it was derived from a common and not remote ancestor with *Hapalops* and has become specialized by the great development of the caniniform teeth. To a certain extent, *Hyperleptus* may be regarded as intermediate between the two genera named, but its peculiar premaxillaries show that it does not form a member of the same series, but is an offshoot from that series. As regards the connection between *Eucholœops* and the Pleistocene genera, Lydekker has made the following suggestion ('94, 98). "The genus, which is evidently a generalized one, is nearly allied to the ancestral stock of both *Mylodon* and *Megalonyx*, if indeed it be not the actual progenitor of both." With this suggestion I am unable to agree. *Eucholœops* is in all respects a typical member of the *Megalonychidæ* and is no more nearly related to *Mylodon* than is any other Santa Cruz representative of this family. As will be shown in a later section, genera much more closely allied to the direct ancestor of *Mylodon* are known in the Santa Cruz fauna, as is also the very probable "actual progenitor" of *Megalonyx*. *Eucholœops*, on the contrary, is almost certainly the final term of a series which because extinct at the close of the Santa Cruz epoch. On the other hand, it is undoubtedly true that in Santa Cruz times the three families of the Gravigrada were much less widely separated than they had become, through divergent evolution, in the Pleistocene, and, in that sense, *Eucholœops* is "nearly allied to the ancestral stock of both *Mylodon* and *Megalonyx*," but not more so, it may be added, than to that of *Megatherium*.

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[1] *E. titan* Lydekker is not referable to this genus, but to *Prepotherium*.

EUCHOLŒOPS INGENS Ameghino.

(Plate LVII, Figs. 2, 2^a, 3.)

Eucholœops ingens Amegh.; Enumeracion sistematica, etc.; 1887, p. 21.
Eucholœops latirostris Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 322.

This, the type-species, is the largest and most massive of the genus, though there is much individual variation in regard to size. In the males, at least, the caniniform teeth are very large, of triangular section and worn by abrasion to a sharp point. The mandible has a short horizontal ramus, which is remarkable for its depth and thickness and for the convexity of its ventral border, that of the ascending ramus being concave and at a much higher level, except for the downward curvature of the angular process, which is unusually broad.

In the collection of the American Museum of Natural History is a mandible (No. 9,307) which probably pertained to a female of this species and is considerably smaller than the robust animals with large caniniform teeth which I have regarded as the males; $_{\overline{1}}$ is hardly larger than in *Hapalops* and projects comparatively little beyond the line of the other teeth; in cross-section it is obscurely trihedral, with the base presenting forward, and is very obliquely worn; $_{\overline{2}}$ and $_{\overline{3}}$ are broad transversely, compressed antero-posteriorly, and $_{\overline{4}}$ is irregularly cylindrical. The jaw has a much less robust horizontal ramus than that of the supposed male, with less convex ventral border; the predental beak is very broad at the base and hardly at all notched for $^{\underline{1}}$. On each side, near the median line, are two conspicuous mental foramina, one above the other, of which the lower is considerably the larger.

MEASUREMENTS.

	No. 9,307.	*Male* (*Amegh. Coll.*).
Lower dentition, length	.0465	.047
“ “ “ $_{\overline{2}-\overline{4}}$	.0265	.026
$_{\overline{1}}$, length (*i. e.*, antero-posterior diameter)	.0055	.008
“ width (*i. e.*, transverse diameter)	.005	
$_{\overline{2}}$, length	.007	.007
“ width	.0105	
$_{\overline{3}}$, length	.0065	.005
“ width	.0105	
$_{\overline{4}}$, length	.009	
“ width	.010	
Mandible, length from condyle	.130	
“ “ “ “ to $_{\overline{1}}$, inclusive	.099	.114
“ “ “ angle to $_{\overline{1}}$, inclusive		.122
“ depth at $_{\overline{3}}$	.036	.044
“ thickness at $_{\overline{3}}$	.021	
“ height of condyle		.062
“ “ “ coronoid		.074

The following measurements of the type-specimen are taken from Ameghino ('89^b, 693–4).

Upper dentition, length	.071
Lower “ “	.055
Upper diastema, length	.023
$^{\underline{1}}$, length	.011
“ width	.010
$^{\underline{2}}$, length	.0075
“ width	.011
$^{\underline{3}}$, length	.0075
“ width	.012
$^{\underline{4}}$, length	.0075
“ width	.0125
$^{\underline{5}}$, length	.006
$^{\underline{5}}$, width	.0085
$_{\overline{1}}$, length	.011
“ width	.014
Diastema, lower, length	.013
Lower dentition, length $_{\overline{2}-\overline{4}}$	.031
Palate, length	.070
“ width at $^{\underline{1}}$	.039
“ “ between molariforms	.026
Skull, length condyle to $^{\underline{1}}$	.172
“ width over $^{\underline{1}}$	.062
Mandible, length of beak	.035
“ depth below molariforms	.035

EUCHOLŒOPS EXTERNUS Ameghino.

(Plate LVI, Fig. 1.)

Eucholœops externus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 322.

The type-specimen is a finely preserved skull and mandible in the Ameghino collection and, if its peculiarities are not abnormal, the species is well distinguished. The principal characteristic is given by the shape of the caniniform teeth, which are very large and indicate that the animal was a male; the lower one bites *inside* of the upper one, instead of behind it, and thus its abraded surface presents outward, not forward as it does in almost all other known Santa Cruz Gravigrada; similarly the worn surface of $\frac{1}{\ }$ is internal, not posterior. The dimensions of this specimen are as follows and show that this species is considerably smaller than the preceding one.

MEASUREMENTS.

Upper dentition, length	.060	Lower dentition, length	.048
" diastema, length	.019	Skull, length condyle to anterior nares	.148

EUCHOLŒOPS FRONTO Ameghino.

(Plates LV; LVI, Figs. 2–4 *a*; LVII, Fig. 1.)

Eucholœops fronto Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 322.
Eucholœops latifrons Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 15.
Eucholœops lafonei Mercerat; Ibid, p. 16.

The following description is founded upon the types of Ameghino and Mercerat, upon an incomplete skull, with mandible and several bones of the skeleton (No. 9,241) in the American Museum of Natural History, and a second mandible (No. 9,575) in the same collection, and upon a mandible and several vertebræ (No. 15,314) in the Princeton Museum. The dimensions, though variable, are much less than those of *E. ingens.*

The teeth vary considerably in size and shape, apparently even in individuals of the same sex. In the supposed females the caniniforms are quite small and in the type of *E. latifrons* Mercerat (figured by Lydekker, '94, Pl. LIX, fig. 4; LX, 1) which is probably a young female, the upper caniniform is very small, laterally compressed and projecting relatively little beyond the line of the upper teeth, and of a shape resembling that seen in *Hapalops.* In the males the caniniforms are large, trihedral and pointed by wear, similar to those of *E. ingens* in shape, but somewhat smaller proportionately. The upper molariform teeth are broad transversely, much compressed antero-posteriorly and either oval or obscurely trapezoidal ; in the mandible these teeth are more constantly oval.

MEASUREMENTS.

	Type.	*E. latifrons.*	*E. lafonei.*
Upper dentition, length	.060	.054	.063
" " " $\underline{2-5}$	.032	.031	.034
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.008	.008	.0105
" width (*i. e.*, transverse diameter)	.006	.005	.008
$\underline{2}$, length	.0065	.0068	.0065
" width	.010	.0095	.0095
$\underline{3}$, length	.007	.007	.0065
" width	.011	.011	.0105
$\underline{4}$, length	.006	.007	.006
" width	.011	.010	.010
$\underline{5}$, length	.005	.005	.005
" width	.009	.008	.008

	Type.	*No. 9,241.*	*No. 9,575.*	*No. 15,314.*
Lower dentition, length	.037	.041	.041	.043
" " " $\overline{2-4}$	.024	.026	.026	026
$\overline{1}$, length	.007			.007
" width				.006
$\overline{2}$, length	.006	.007	.007	006
" width		.010	.010	.009
$\overline{3}$, length	.0065			.0065
" width				.010
$\overline{4}$, length	.008			.007
" width				.0095

So far as can be judged from the available specimens, the skull resembles that of *E. externus*, with elongate and rather narrow cranium, short and very broad face ; the upper contour of the skull is straighter than in most species of *Hapalops*, the parietal eminence rising but little above the summit of the occiput. As appears to be always the case in this genus, the occipital crest is much better defined than in *Hapalops* and the sagittal crest, though low and thin, is very distinct and ends anteriorly in rugose temporal ridges. The postorbital constriction is much shallower than in *Hapalops*, but the preorbital fossæ are made very deep by the conspicuous prominence of the caniniform alveoli.

The occiput is low and wide, is inclined slightly forward and is almost plane, except for a broad median convexity, which bears near the dorsal summit a short and sharp vertical ridge, with a small but deep pit on each side of it; the condyles are rather small and are separated ventrally by a deep and narrow notch; the foramen magnum is a vertical oval and the paroccipital processes are quite long; the basioccipital is broad, unkeeled, and anteriorly is nearly plane, becoming strongly convex behind, where a deep depression is formed on each side between the condyle, tympanic and paroccipital process. The mastoid portion of the periotic, which is quite extensively exposed, lies in a deep fossa between the squamosal and exoccipital.

Owing to the shallowness of the postorbital constriction, the frontals have less of the hour-glass shape than those of *Hapalops*, and much more prominent sagittal crest and temporal ridges; the forehead is nearly plane longitudinally, slightly convex transversely, the sinuses not causing any external protuberances; the anterior border has two shallow emarginations for the nasals, without distinct nasal processes. As compared with those of *Hapalops*, the nasals are short, very broad and moderately arched both longitudinally and transversely; at the anterior end they are somewhat broadened and decurved to follow the maxillaries; another and a very marked difference from the last named genus is to be seen in the anterior ends of the nasals, which are not deeply notched, but abruptly truncate and, consequently, have no lateral processes.

The premaxillæ (Plate LVI, fig. 2), are of the same general plan as those of *Hapalops*, but have nevertheless quite a different appearance; they are very short and are lodged in so deep a notch of the bony palate that they project very little in front of the caniniform teeth; the anterior branch is very short, rather slender, and contracts rapidly forward; on the other hand, the postero-external branch is very broad, much broader than in any known species of *Hapalops* and the spine is narrower, though quite heavy; the incisive foramen is thus reduced to a narrow oval, considerably smaller than in *Hapalops*, but much larger than the narrow slit of *Hyperleptus*. The maxillary is long and low, with short preorbital portion, which ends abruptly in the broad, rounded, pillar-like sheath of the caniniform tooth; the preorbital fossa is very deep and has a well defined dorsal border; the depth of these fossæ, the great width of the muzzle in front of them, and the shortness of the premaxillaries give a highly characteristic appearance to this region of the skull; dorsally, the facial portion of the maxillary is curved toward the median line, overlapping the edge of the nasals and forming a considerable part of the roof of the broad nasal chamber. The zygomatic process of the maxillary is rather short, but is given an appearance of prominence by the depth of the preorbital fossa; the infraorbital foramen is small. The lachrymal is like that of *Hapalops* except that the foramen is narrower and more slit-like. The palatine processes of the maxillaries are remarkable for their great expansion in front of the molariform teeth and for the great depth of the V-shaped notch which lodges the premaxillæ; between the molariforms the palate is rugose, but only moderately convex. The palatines are short and together form a triangular plate, with sharp apex directed forward; the posterior nares are very broad and their front border is behind the last tooth.

The mandible (Plates LV, figs. 1*d*, 2; LVI, 4, 4*a*) has a short, but extremely thick and heavy horizontal ramus, with strongly convex ventral border; the symphysis is short and steeply inclined and the chin is abrupt; the predental beak is very short, deeply constricted at the base by a notch on each side for the upper caniniform, and of triangular shape, contracting to a point anteriorly; as a rule, the dorsal surface is but moderately concave and the lateral borders are depressed and everted. In one specimen, however, which is apparently referable to this species (A. M. N. H., No. 9,575, Plate LVI, 3, 3*a*) the beak has quite a different appearance; the notches for $\underline{1}$ are unusually large and deep and, seen from above, the beak is cordiform, rather than triangular, and is more concave, with margins less everted. An apparently constant difference of the present species from *E. ingens* is in the mental foramina, of which a single conspicuous one is found on each side of the base of the beak. The coronoid process is higher and more erect, less inclined and recurved than in *E. externus*, but the angular process is considerably shorter.

MEASUREMENTS.

	Type.	*No. 9,241.*	*No. 9,575.*	*No. 15,314.*
Occiput, height		.043		
" width at base		.058		
Skull, width at postorbital constriction		.038		
" " over $\underline{1}$	.042			
Palate, width at $\underline{1}$	.026			
" " " $\underline{5}$	.016			
Mandible, length from condyle	.113		.115	.119
" " " angle				.128

MEASUREMENTS.

	Type.	*No. 9,241.*	*No. 9,575.*	*No. 15,314.*
Mandible, length of predental beak	.021		.027	.026
" depth below $_{\overline{3}}$	.030		.028	.030
" thickness below $_{\overline{3}}$		.016	.017	.017
" length condyle to $_{\overline{4}}$	.052		.052	.049

Except in a few details, the vertebræ (Plate LVII, fig. 1) are very similar to those of *Hapalops*. The atlas is broader in proportion to its length, a difference which is principally due to the larger size of the transverse processes; the neural arch is narrower antero-posteriorly, not extending over the posterior pair of cotyles and more distinctly emarginate between the anterior pair; the latter are quite closely approximated and ventrally are separated only by a deep and narrow notch; the inferior arch is slender and has a more prominent hypapophysis than in *Hapalops*, while the transverse processes are longer and have a more regularly curved free border. The neural spine of the axis is much larger than in the last named genus, extending well over the atlas. In the other cervical vertebræ the principal difference from *Hapalops* consists in the narrower neural arches and the larger neural spines and transverse processes. In the anterior thoracic region also the spines are longer and on the first and second vertebræ they are nearly erect. The posterior thoracics, lumbars and sacrals are not known.

Associated with the American Museum specimen (No. 9,241) are nine caudals from the anterior part of the tail and these are supplemented by an individual (No. 15,314) in the Princeton collection, which has a number of the caudals, including a series of nine from the hinder part of the tail, lacking not more than two or three terminal vertebræ; the full number of caudals can therefore hardly have exceeded twenty or twenty-one. As a whole, the tail is much like that of *Hapalops*, of moderate length, but very heavy, rapidly tapering behind, while the individual vertebræ are of the type common to all of the known Santa Cruz Gravigrada; the centra diminish steadily in diameter, but very gradually in length as far as the tenth caudal; from the latter backward the decrease in size is much more rapid and is accompanied by a marked depression or flattening in the hinder part of the tail; the facets for the chevrons are very obscure, if present at all, on the first caudal, but each succeeding vertebra to the ? fifteenth has two prominent pairs of such facets, the anterior pair separated from the posterior by transverse grooves. The neural arch is high on Cd. 1 and continually decreasing in size, becomes an open groove on ?13; the spine is not distinguishable beyond 6; the zygapophyses, which are at first very conspicuous, diminish *pari passu* with the reduction of the neural arch, from ?14 they are mere vestigial tubercles and they are absent on ?18. The transverse processes are very long, broad and depressed on 1, and, though rapidly reduced in length, they are still distinct on ?18; on 2 and 3 these processes have curious expansions of the distal end, are quite slender from 4 to 7, and from 8 to ?13 again have well defined distal expansions. The chevrons are known only from the hinder part of the tail and three are present with the caudals of No. 15,314; these are very small canoe-shaped bones, with a deep vascular channel, which is almost closed dorsally by the lateral expansion of the facets for the vertebral centra; two of the chevrons have each two pairs of such facets, while the smallest of the three, which was apparently attached to the ?fourteenth caudal, has but a single pair.

In the subjoined table the dimensions of caudals ?11, ?13, ?16 and ?18 are from No. 15,314, all the other measurements from No. 9,241.

MEASUREMENTS.

Atlas, length	.0315
" width	.062
" height	.032
Axis, length of centrum (excluding odontoid)	.023
" width of anterior face	.0305
" " " posterior face	.017
" " " neural spine (fore and aft)	.036
Third cervical, length of centrum	.018
" " width of anterior face	.015
Fifth cervical, length of centrum	.018
" " width of anterior face	.014
Seventh cervical, length	.017
" " width of anterior face	.015
Neck, length in a straight line	.144
First thoracic, length of centrum	.019
" " width of anterior face	.014
" " height (including neural spine)	.059
Second thoracic, length of centrum	.018
" " width of anterior face	.017
" " height	.061
First caudal, length of centrum	.022
" " width of anterior face	.027
" " " over transverse processes	.109
" " height	.037
Fifth caudal, length of centrum	.022
" " width of anterior face	.0215
" " " over transverse processes	.063
" " height	.033
Seventh caudal, length of centrum	.021
" " width of anterior face	.020
" " " over transverse processes	.0565
" " height	.030
Ninth caudal, length of centrum	.020
" " width of anterior face	.019

Measurements.

Ninth caudal, width over transverse processes	.0425
? Eleventh caudal, length of centrum	.0185
“ “ width of anterior face	.017
“ “ “ over transverse processes	.038
“ “ height	.023
? Thirteenth caudal, length of centrum	.016
“ “ width of anterior face	.014
“ “ “ over transverse processes	.024
? Sixteenth caudal, length of centrum	.0135
“ “ width of anterior face	.011
“ “ “ over transverse processes	.016
? Eighteenth caudal, length of centrum	.0105
“ “ width of anterior face	.009
“ “ “ over transverse processes	.0125

Of the fore-limb only the radius is known; it resembles that of *Hapalops*, but is more slender in proportion to its length; the proximal facet for the ulna is remarkably small and is confined to the postero-external aspect of the head; the surface for the humerus is transversely oval and has, in addition to the usual concavity, a narrow plane facet on the inner side; the bicipital tubercle is very large; the shaft is slender and antero-posteriorly compressed.

The pes is represented by the second and third digits. These are more of the *Analcimorphus* than of the *Hapalops* type. Metatarsal II is more elongate and slender than in the latter and the proximal end overlaps the head of metatarsal III more extensively, but has no facet for the ectocuneiform; the distal trochlea is more asymmetrical than in *Hapalops*, the great carina being displaced more toward the fibular border and projecting less on the dorsal, more on the plantar side; on the dorsal side of the shaft, above the distal trochlea, is a large fossa not indicated in *Hapalops*. Metatarsal III, though short and stout, is conspicuously longer and more slender than in the last named genus, and the proportions of these two metatarsals suggest that IV and V also were less abruptly different from III than in the latter.

In digit II the proximal phalanx is long and narrow, very thick planto-dorsally; in digit III this phalanx is of nearly the same length and, though broader and far thicker than in II, is proportionately much less massive than in *Hapalops*. The second phalanx is very long and quite slender and in III is more elongate and less heavy than in the last named genus. The unguals also differ in shape from those of the latter, being more decurved, with wider and more regularly arched, less sloping dorsal border, and the cleft at the distal end is almost obsolete.

MEASUREMENTS.

Radius, length	.155
" width of proximal end	.0235
" thickness of proximal end	.018
" width of distal end	.0285
Metatarsal II, length	.029
" " width of proximal end	.016
" " " " distal end	.0135
Metatarsal III, length	.0265
" " width of proximal end	.019
" " " " distal end	.017
First phalanx, digit II, length	.013
" " " " proximal width	.014
" " " " " thickness	.019
First phalanx, digit III, length	.017
" " " " proximal width	.016
" " " " " thickness	.0215
Second phalanx, digit II, length	.025
Second phalanx, digit II, prox. width	.012
" " " " " thickness	.017
" " " " distal thickness	.011
Second phalanx, digit III, length	.023
" " " " prox. width	.015
" " " " " thickness	.021
" " " " distal thickness	.015
Ungual, digit II, length	.048
" " " proximal width	.0105
" " " " thickness	.016
Ungual, digit IV, length	.044
" " " proximal width	.012
" " " " thickness	.016
Digit II, length	.095

EUCHOLŒOPS CURTUS Ameghino.

Eucholœops curtus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 154.

For the present, at least, it is desirable to keep this species distinct, for the type and only known specimen is a very curious skull, remarkable for its shortness and great breadth. To a certain extent, this shortness is more apparent than real, for the skull has been "telescoped" by a longitudinal compression, but even after making due allowance for this, the proportions remain very unusual.

The dentition does not differ from that of *E. fronto*, more than the teeth of various individuals of the latter differ from one another, and the peculiarities of the skull are best indicated in the measurements.

MEASUREMENTS.

Upper dentition, length	.056
" " " $\underline{2}$–$\underline{5}$	.028
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.009
" width (*i. e.*, transverse diameter)	.008
$\underline{2}$, length	.0045
" width	.009
$\underline{3}$, length	.005
" width	.009

Measurements.

$\underline{4}$, length	.005	Cranium, length occipital crest to rim of orbit	.083
" width	.008	Face, length orbit to anterior nares	.034
$\underline{5}$, length	.003	Occiput, width	.058
" width	.0075	Face, width over $\underline{1}$	.046
Skull, length in median basal line	.094	Palate, length in median line	.046
" " condyles to anterior nares	.117	" width at $\underline{1}$	.026
" " width at postorbital constriction	.034	" " " $\underline{5}$	.013

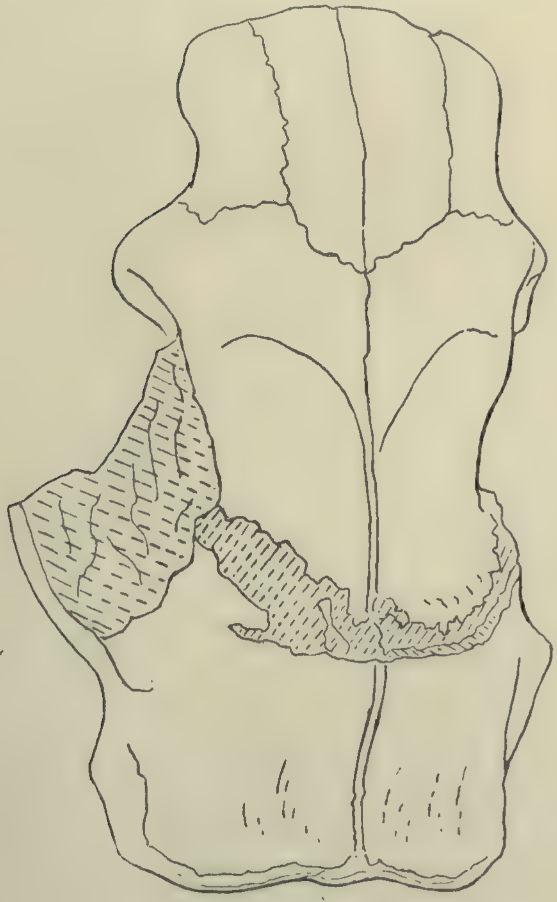


FIG. 33.

Eucholœops curtus, type; × $\frac{1}{1}$. Ameghino Collection.

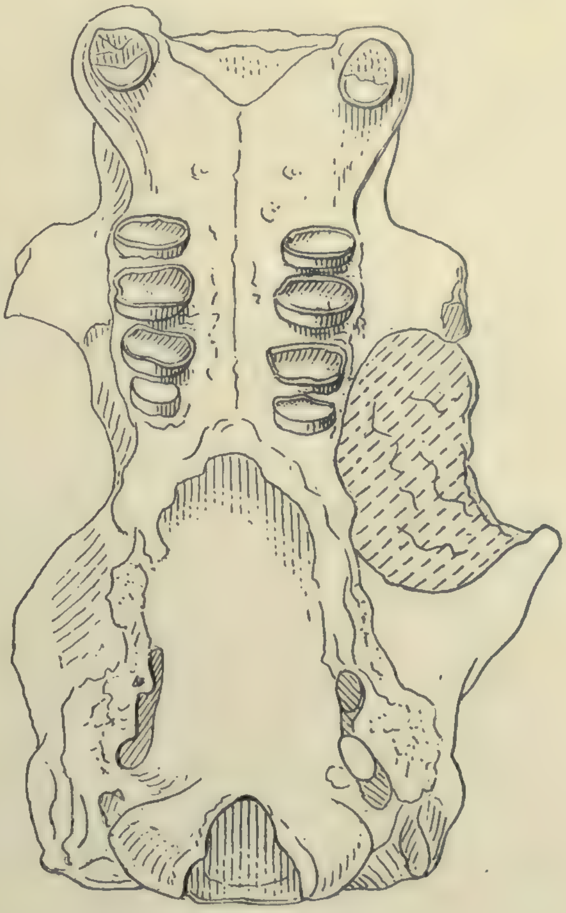


FIG. 34.

Eucholœops curtus, type; × $\frac{1}{1}$. Ameghino Collection.

MEGALONYCHOTHERIUM gen. nov.

(Plate XLVI.)

This genus is represented by a single skull, without mandible (No. 15,593) from which unfortunately, all the teeth are missing, except the basal portion of $^{\underline{3}}$ on the right side. In general character the skull is much like that of *Hapalops*, but the resemblance to *Megalonyx* is so much more striking than in the case of any other known Santa Cruz fossil, that it seems advisable to separate it generically from the former.

The dentition has a very suggestive resemblance to that of *Megalonyx*, as is evident from the empty alveoli; $^{\underline{1}}$ is much larger than in *Hapalops* and of an entirely different shape, obviously resembling the same tooth in *Megalonyx*, being laterally compressed and antero-posteriorly elongate, but is more trihedral and less oval than in the Pleistocene genus, with the anterior surface a rounded edge and the posterior relatively broad; the tooth is placed as far forward as possible in the maxillary, which has no plate-like extension in front of it, such as occurs in *Hapalops*, and no such rounded, pillar-like expansion as is found in *Eucholœops*, for it does not project outside of the line of the other teeth, as it does in the latter. The first molariform tooth, $^{\underline{2}}$, which is separated by a considerable diastema from $^{\underline{1}}$, is similar in form to that of *Megalonyx*, but relatively larger; $^{\underline{3}}$ and $^{\underline{4}}$ are of nearly equal size and resemble those of the Pleistocene genus, while $^{\underline{5}}$ is proportionately smaller than in the latter.

In the skull also there is a suggestive resemblance to *Megalonyx*, with many differences in matters of detail. In general proportions the following differences from *Megalonyx jeffersoni* may be noted: The cranium is relatively shorter and the face longer, but, at the same time, the diastema is shorter; these differences are largely due to a shifting of the orbits in the Pleistocene species, in which the front rim of the orbit is well in advance of $^{\underline{2}}$, making the preorbital region extremely short, while in the Santa Cruz genus the edge of the orbit is over the space between $^{\underline{2}}$ and $^{\underline{3}}$; the whole skull, especially the facial region, is much shallower dorsoventrally; the postorbital constriction is shallower and more anterior in position, while the preorbital fossæ are much more distinctly defined; the zygomatic process of the squamosal is more slender and much more horizontal in direction. The sagittal and occipital crests are quite prominent, the former more so than in any other known genus of the Santa Cruz Gravigrada, and the muzzle is broad and abruptly truncate.

In the entire absence of the skeleton, it is impossible to speak with confidence regarding the relationships of this genus, but, so far as can be judged from the dentition and skull, there is no apparent reason why it may not have been the direct ancestor of *Megalonyx;* on the other hand, it was clearly derived from the same stock as *Hapalops.*

MEGALONYCHOTHERIUM ATAVUS sp. nov.

(Plate XLVI.)

This species, the type of which (No. 15,593) was found by Mr. Peterson on the coast of Patagonia, about five miles south of Coy Inlet, is of moderate size, about equal in this respect to *Hapalops brachycephalus.*

The dentition has been sufficiently described in the generic diagnosis and it only remains to notice that the two series of upper teeth are nearly parallel and to give the dimensions.

MEASUREMENTS.

Upper dentition, length	.061	$\underline{3}$, length	.007
" " " $\underline{2}$–$\underline{5}$	.033	" width	.012
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.011	$\underline{4}$, length	.0085
" width (*i. e.*, transverse diameter)	.007	" width	.011
$\underline{2}$, length	.0085	$\underline{5}$, length	.007
" width	.011	" width	.008

As the most significant fact concerning this animal is its probable ancestral relationship to *Megalonyx*, it will be well to make a detailed comparison of the skull with that of *M. jeffersoni.* The occiput of the Santa Cruz species, though of similar semicircular form, is relatively somewhat wider and lower, and the foramen magnum is larger, though of the same almost circular outline; the median vertical ridge on the occiput is much wider, more rounded and less prominent, and the occipital crest is more distinctly defined and much narrower, not forming such a broad, rugose surface; the condyles are missing and the paroccipital processes, though inconspicuous, are larger than in the Pleistocene species. All of the elements forming the cranio-facial axis are indistinguishably fused together; this axis is relatively longer and narrower than in *Megalonyx;* the basioccipital is similar in the two species, with convex median portion and on each side a fossa into which open the condylar foramen and foramen lacerum posterius. The mastoid portion of the periotic is quite extensively exposed on the surface of the occiput between the exoccipital and squamosal and forms a prominent ridge with a deep and narrow fossa on each side of it; in the outer one of these fossæ is a large venous foramen; ventrally the periotic ends in a large, subcylindrical mastoid process, with a cup-shaped surface for the stylo-hyal. The parietals are large and form nearly the whole cerebral roof, with prominent sagittal crest extending along their entire length. The squamosal is also large and extends to the occipital surface, making up nearly half of the occipital crest; ventrally this crest ends in a prominent tubercle, which is smaller than in *M. jeffersoni* and nearer to the mastoid process; the zygomatic process is much like that of *Hapalops* and pursues a horizontal course, not curving downward, nor diverging so far from the side of the skull as in *Megalonyx;* another difference from the latter is that the dorsal border of the zygoma does not become continuous with the occipital crest.

The temporal ridges of the frontals are much less prominent than in the Pleistocene species and the postorbital processes seem to have been insignificant; the frontal sinuses are much less prominent and the forehead is but moderately convex. The lachrymal resembles that of the other Santa Cruz Gravigrada and is far more prominent than in *Megalonyx*. The nasals are short, unusually broad, moderately curved longitudinally and almost plane transversely. The anterior nares are quite large and considerably higher than they are wide; in shape they are much as in the Pleistocene species, but are covered more by the nasals and less by the maxillaries.

The premaxillæ have been lost, but from the facets on the maxillaries and the smaller, more V-shaped notch of the anterior border of the palate, it may be inferred that they were longer and more slender than in *Megalonyx*. The maxillary is longer than in the latter, especially the preorbital portion, with much better defined preorbital fossa and far more prominent zygomatic process; the hard palate is very rugose and is perforated by many venous foramina, but the region between the molariform teeth is less convex than in many Santa Cruz species and conspicuously less so than in *M. jeffersoni*. The posterior nares have a shape similar to that of the latter, but differ in the wide separation, dorsally, of the pterygoids, which, in the Pleistocene species, meet in the median line and conceal the presphenoid and part of the basisphenoid. Part of the vomer is visible, descending gradually forward into the nasal chamber.

Measurements.

Skull, length in median basal line	.136	Distance, condyle to glenoid cavity	.027
Cranium, length occipital crest to edge of orbit	.100	" " " $\underline{5}$	.071
Face, length from orbit to anterior nares	.036	Rostrum, width	.038
Occiput, height	.040	Anterior nares, width	.024
" width at base	.055	Palate, length in median line	.056
Cranium, width at postorbital constriction	.031	" width at $\underline{1}$	.024
" " over lachrymals	.048	" " " $\underline{2}$	.013
Zygomatic arch, length	.082	" " " $\underline{5}$	.012

We may next consider a group of three genera, *Schismotherium*, *Pelecyodon* and *Analcimorphus*, which are in some important respects more primitive than any of the genera described in the preceding pages; they agree with one another in certain characters which, at first sight, seem to be very trivial, but are so remarkably constant that they must be regarded as significant. The first upper, or caniniform, tooth is implanted at a greater or less distance behind the anterior edge of the palate, and the second upper tooth, which in all other known Santa Cruz Gravigrada is transversely oval or rectangular, is, without exception, subcylindrical or styliform. The digits of the pes are more uniform in length than in *Hapalops*.

ANALCIMORPHUS Ameghino.

(Plates XLVII–XLIX.)

Analcimorphus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 320.

Ameghino has referred this genus to the *Planopsidæ* (*Prepotheriidæ* Amegh.), a reference which was justified by the similarities of the dentition, but the discovery of a large part of the skeleton shows that this genus is an undoubted member of the *Megalonychidæ* and, in particular, is nearly allied to *Schismotherium* and *Pelecyodon*. The type-species, *A. inversus*, is still very imperfectly known and it remains to be proved whether the second and very much larger species, *A. giganteus*, is or is not properly referable to the same genus. So far, however, as the known material permits of a decision, there is no reason to separate the two species generically.

Analcimorphus is characterized primarily by the dentition, which has certain marked resemblances to that of the *Planopsidæ*. In the upper jaw $\underline{1}$ is small, cylindrical, horizontally abraded and inserted far behind the anterior margin of the palate and separated from $^{\underline{2}}$ by a shorter, yet considerable, diastema; $^{\underline{2}}$ is subcylindrical, the antero-posterior diameter equalling or exceeding the transverse; $^{\underline{3}}$ and $^{\underline{4}}$ are transversely oval, very broad, much compressed antero-posteriorly and of nearly equal size; $^{\underline{5}}$ is similar, but smaller. Of the mandibular dentition, $_{\overline{1}}$ is caniniform, small, subcylindrical, horizontally worn and separated from $_{\overline{2}}$ by a somewhat shorter diastema than that of the upper jaw; $_{\overline{2}}$ and $_{\overline{3}}$ are transversely oval or rectangular, broad, but less antero-posteriorly compressed than $^{\underline{3}}$ and $^{\underline{4}}$, while $_{\overline{4}}$ is again cylindrical.

As the skull and skeleton are known only in *A. giganteus*, they will be described in connection with that species.

ANALCIMORPHUS INVERSUS Ameghino.

Analcimorphus inversus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 320.

The type and only specimen of this species consists of a fragment of the right half of the palate with the second, third and fourth teeth in place, and the right ramus mandibuli, lacking the predental beak and the angular process, but retaining all of the teeth. That the animal was very young is shown by the open palatal suture, but its small size is not entirely due to youth and it could never have approximated the large species in stature.

Except in regard to size, the dentition displays little that is specifically characteristic; $^{\underline{2}}$ tends to assume a trihedral form, with the apex turned forward; $^{\underline{3}}$ and $^{\underline{4}}$ are very much compressed antero-posteriorly, while $_{\overline{2}}$ and $_{\overline{3}}$ are less compressed and more rectangular and $_{\overline{4}}$ is very regularly cylindrical.

The ventral border of the jaw is but moderately convex, and though the immaturity of the animal may partially explain this, the great difference in the form of the mandible between this species and *A. giganteus* cannot be entirely accounted for in this manner. The postero-external opening of the dental canal is double, but, as may be inferred from the analogy of *Hapalops*, this is doubtless individual.

MEASUREMENTS.

$^{\underline{2}}$, length (*i. e.*, antero-posterior diameter)	.007	$^{\underline{3}}$, length	.006
$^{\underline{2}}$, width (*i. e.*, transverse diameter)	.006	" width	.010
		$^{\underline{4}}$, length	.0055

MEASUREMENTS.

^{4}, width	.010	$_{3}$, length	.005
Lower dentition, length	.031	" width	.006
" " " $_{2-4}$	.0205	$_{4}$, length	.007
$_{1}$, length	.003	" width	.0065
$_{1}$, width	.0025	Mandible, depth below $_{3}$	.019
$_{2}$, length	.0045	" length condyle to $_{1}$	.068
" width	.0065		

ANALCIMORPHUS GIGANTEUS Ameghino.

(Plates XLVII–XLIX.)

Analcimorphus giganteus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 165.

In addition to the type in the Ameghino collection, this species is represented in the Princeton Museum by two individuals, one of which (No. 15,163, Plate XLVII) is a fine skull, lacking most of the occiput and the mandible, and the other (No. 15,561, Plates XLVIII, XLIX) consists of the skull, without mandible, four cervical, twelve thoracic, four lumbar and three caudal vertebræ, the sacrum, pelvis, hind-limb and pes almost complete. Both specimens were found by Mr. Peterson near Corriken Aike. At first sight, the two skulls appear to be quite different in their proportions, so much so that I was inclined to separate them specifically and have, on p. 174, labelled the figure of the pes as *A. leptocephalus*, but the difference is at least partially due to the fact that the isolated skull, which was imbedded in a soft matrix, is free from distortion, while the other, which was in a very hard concretion, has been laterally compressed and thus seems to be unduly narrow.

The most obvious distinction of this species from the preceding one is its very much larger size, but there are additional differences in the teeth. Of the upper series ^{1} is the smallest and the portion protruded from the alveolus is very small, both in height and in diameter; it is of irregularly oval section and recurved; the grinding surface is inclined; the tooth is inserted well behind the anterior border of the palate and is followed by a considerable diastema; ^{2} is styliform, of oval or irregularly quadrate section, and has an inclined masticating surface, with high anterior and very low posterior crest, enclosing a rounded, shallow depression; ^{2} and all the succeeding teeth are isolated by considerable interspaces; ^{3}, the largest of the series, is transverse and either oval or pyriform in shape;

the anterior crest is curved and terminates internally and externally in elevated points, concealing the valley in side-view; $^{\underline{4}}$ resembles $^{\underline{3}}$, but is smaller and more constantly oval and $^{\underline{5}}$ is quite small. The teeth are somewhat oblique to the median line of the palate and the two series are nearly parallel.

In the mandibular dentition, which is known only from the type, $_{\overline{1}}$ is very small, cylindrical, horizontally abraded, and separated from $_{\overline{2}}$ by quite a long diastema; $_{\overline{2}}$ and $_{\overline{3}}$ are transversely oval, more compressed antero-posteriorly and less rectangular than in *A. inversus*, and $_{\overline{4}}$ is less cylindrical than in the latter and more obliquely elliptical.

Measurements.

	Type.	*No. 15,561.*	*No. 15,163.*
Upper dentition, length		.0605	.0545
" " " $\underline{2-5}$	.041	.042	.037
" " " $\underline{3-5}$	.030	.030	.027
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)		.006	.0055
" width (*i. e.*, transverse diameter)		.005	.005
$^{\underline{2}}$, length	.008	.0085	.008
" width	.008	.008	.008
$^{\underline{3}}$, length	.008	.007	.008
" width	.013	.0145	.014
$^{\underline{4}}$, length	.0075	.007	.007
" width	.012	.0125	.012
$^{\underline{5}}$, length	.006	.007	.007
" width	.0095	.0115	.0115

The dimensions of the lower teeth are all taken from the type.

Lower dentition, length	.052	$_{\overline{2}}$, width	.013
" " " $\overline{2-4}$	.034	$_{\overline{3}}$, length	.007
$_{\overline{1}}$, length	.005	" width	.012
" width	.005	$_{\overline{4}}$, length	.011
$_{\overline{2}}$, length	.0075	" width	.010

Skull (Plates XLVII, XLVIII). — The general appearance is quite like that of the larger species of *Hapalops*, but with many minor differences. The occiput is relatively high and from its summit to the parietal eminence the rise is slight and from the eminence to the coronal suture, the lowest point of the cranium, is a slight descent; from the coronal suture is an almost imperceptible rise to the interorbital region and thence a very gentle descent to the muzzle, which is quite high dorso-ventrally. The cranium is of nearly uniform width, the cerebral expansion and the post-orbital constriction being moderate and the broadening of the forehead slight; the preorbital fossæ are shallow and the broad rostrum has nearly parallel sides.

The basioccipital is short and wide, nearly flat and without keel, and deeply emarginated by the foramen magnum; the condylar foramen is very large and conspicuous, while the foramen lacerum posterius is still larger and is chiefly, if not entirely, enclosed in the basioccipital; the foramen magnum is low and wide, of transversely oval shape and with dorsal margin so prominent as to give it something of a tubular form; the paroccipital processes are small but distinct; the condyles are relatively larger than in most other contemporary species and are not so sessile; they project freely behind the plane of the occiput and form the hindermost part of the skull; the ventral notch between the condyles is unusually deep, much as in *Megalonyx*. As a whole, the occiput is high, inclined decidedly forward, bringing the summit on a line with the auditory meatus; it is strongly convex transversely, with median prominence for the vermis; the inclination of the occiput is more decided than in most of the Santa Cruz Gravigrada, exposing the condyles when the skull is seen from above; the occipital crest is very distinct, though not very prominent, and dorsally curves forward between the parietals, clearly demarcating them from the supraoccipital. The mastoid portion of the periotic is narrow and rugged and ends ventrally in a short, cylindrical process for the attachment of the stylohyal. The tympanic is, as usual, a mere bony ring, with large and irregular auditory meatus. The basisphenoid is long and broad, lying at a lower level than most of the basioccipital, which descends to meet it; the presphenoid is concealed by an expansion of the vomer, of which the anterior visible portion is a thin, vertical plate with ventral border descending forward, while the hinder part is a horizontal plate covering much of the presphenoid; except for a large descending process, the alisphenoid is quite small, but the orbitosphenoid is relatively large.

The parietals are large in both dimensions; for most of its length the sagittal crest is feebly indicated, becoming more distinct anteriorly; the vascular foramina along the parieto-squamosal suture are few. The squamosal is long and low and forms but little of the occipital crest, and develops a prominent tubercle at the postero-inferior angle; the posttympanic process is very small, and the zygomatic process is short and nearly straight, with a slight downward curvature; the jugal, which is missing, must have been unusually long. The lachrymal, which is of the ordinary type, appears to be less prominent than in many other species, on account of the breadth of the rostrum; in No. 15,163 the foramen is considerably smaller than in the other skull, but the difference is probably individual. The frontals have less of the hour-glass shape than usual, owing to the shallowness of the postorbital constriction; large sinuses are indicated by the convexity of the forehead; the sagittal crest is quite distinct and bifurcates into well defined temporal ridges; the spine which overhangs the optic foramen is continued as a short ridge along the suture with the orbito-sphenoid. The nasals are long and each one is convex transversely, producing a groove along the median line; they are narrowest at the hinder end, broadening gradually to the anterior end, which projects freely beyond the maxillaries; the lateral notches are shallower than in *Hapalops* and the lateral processes present outward instead of dorsally, very much as in *Mylodon*.

The premaxillæ are missing, but the facets for them indicate that they were of the type common to the *Megalonychidæ*, with certain peculiarities; the facet for the postero-external branch is a high, narrow concavity, which rises unusually far upon the sides of the anterior nares; a second and much smaller facet for the same branch is upon the lateral aspect of the palatine process, while the median notch for the spines is not unlike that of *Hapalops*, but somewhat smaller. The preorbital portion of the maxillary is large and the fossa is of variable depth; the zygomatic process is not very prominent, but is broad antero-posteriorly and is perforated by a relatively small infraorbital foramen. The hard palate is of the type usual in the family, but is wider than in most of the genera and, owing to the irregular sizes of the teeth, its width varies more in the different parts; the posterior convexity is moderate and extends only to the space between $\frac{2}{}$ and $\frac{3}{}$ and in front of this the palate is flat, or slightly concave. A distinct difference between the two specimens is in the shape of the posterior narial opening; in No. 15,163 the front part of this opening is narrow, with a median spine, and extends nearly to the anterior face of $\frac{5}{}$, while in 15,561, it ends behind $\frac{5}{}$, has no spine and is broader. The pterygoids are not entirely covered by the descending plates of the alisphenoids; in one of the skulls (No. 15,163) at the base of each pterygoid, just external to its junction with the basisphenoid, is a broad, conspicuous groove, leading obliquely into the narial canal.

The mandible, known only in the type, can be but partially described, because at the time of my visit to La Plata, the jaw was still partly in the matrix, and the ascending rami and the predental beak are broken. The symphysis is very long, extending back nearly as far as $\overline{2}$, and the beak was evidently long, perhaps very elongate, and is but moderately concave on the dorsal side; the ventral border of the horizontal ramus is strongly convex, greatly increasing the depth of the jaw, which below $\overline{3}$ is 47 mm.; the shape resembles the jaw of *Megatherium* and is quite unlike that of *A. inversus*, in which the ventral border is almost straight.

The stylo-hyal (Plate XLVII, Fig. 1) agrees in its general form with that of the modern sloths and of the Pleistocene Gravigrada; it is hammer-shaped, with proximal end expanded antero-posteriorly and compressed laterally; the surface for the periotic is anterior and forms a small tubercle; the slender shaft is subcylindrical, with a sigmoid curvature.

MEASUREMENTS.

	No. 15,561.	*No. 15,163.*
Skull, length in median basal line	.144	.141
" " condyles to anterior nares	?.168	.171
Cranium, length condyle to edge of orbit	.132	.130
Face, length orbit to anterior nares	?.037	.043
Occiput, height	.042	
" width at base	.059	.060
Skull, width at postorbital constriction	.041	.046
Rostrum, width	.037	.041
Zygomatic arch, length	.100	.096
Palate, length in median line	.072	.059
" width at $\underline{1}$	.021	.024
" " " $\underline{2}$	.017	.018
" " " $\underline{5}$	.016	.014

Vertebral Column (Plate XLIX, figs. 1, 2, 3^b).—The atlas is longer than in *Hapalops longiceps*, with wider neural arch and even more reduced neural spine; the anterior cotyles are farther apart ventrally; the transverse process is more horizontal, less extended antero-posteriorly, not reaching to the anterior cotyle, which projects in front of it, and is separated from the posterior cotyle by a deep notch; on the ventral side of the process, near the posterior border, a prominent, rib-like elevation runs obliquely outward and backward from the side of the inferior arch to the posterior angle of the process, where it ends in a rounded tubercle.

The axis is relatively longer and narrower than in *Hapalops longiceps* and has a prominent ventral keel; the anterior cotyles rise higher upon the sides of the neural canal, which is higher and narrower and more circular; the spine is a large, hatchet-shaped plate, which differs from that of *Hapalops* in the upward slope of the much thickened posterior border; the transverse process is long and slender and the vertebrarterial canal is shorter than in *Hapalops*. The third and fourth cervicals differ little from those of the latter genus, except that the spine, which is considerably higher on 3 than on 4, is higher and more pointed.

The twelve thoracic vertebræ associated with No. 15,561 are from different parts of the region. The anterior thoracics have small centra, which are somewhat contracted in the middle; the neural spines are longer and more slender than those of *Hapalops longiceps* and have a stronger backward inclination, while the tips are more thickened and rugose. In the hinder part of the region the vertebræ have short and massive centra, which in the last two have a median keel and a pair of very small ventral foramina; the neural spines are shorter and much narrower than in *H. longiceps*, but with much heavier tip; the spine of the last thoracic is much broader than that of the penultimate one; transverse processes are prominent on all and even the last one appears to have a facet for the tubercle of the rib; metapophyses are first distinguishable on the antepenultimate vertebra, suddenly becoming very prominent on the penultimate. Accessory zygapophyses are present only on the last vertebræ, or, perhaps, on the last two.

Four lumbar vertebræ are present; they have centra of nearly uniform length, becoming broader and more depressed posteriorly; all have the ventral keel and foramina, but the latter are conspicuous only on the third and fourth, and largest on the third; the neural spines are lower, broader and more erect than those of the posterior thoracic region and are shorter than the lumbar spines of *Hapalops longiceps;* the transverse processes are shorter and less antroverted than in the latter species, and the accessory zygapophyses are like those common to all the family.

The sacrum consists of five vertebræ, of which the first is less completely incorporated than the others and seems to belong to the lumbar series; the centrum of this vertebra is not coösified with the second, though it probably became so in the fully adult animal, and the neural spine is also free, but the posterior pair of zygapophyses are fused with the anterior pair of the succeeding vertebra and the transverse processes, which are of lumbar type, though much longer than in any of the preceding vertebræ, are fused with the ilia; the absence of pleurapophyses further distinguishes this vertebra from the first true sacral. The four succeeding vertebræ are thoroughly coössified, their spines forming a ridge which is notably lower than in *H. longiceps;* the first two are ankylosed with the ilia and the fourth with the ischia.

The first three caudal vertebræ are quite like those of *H. longiceps*, but have somewhat smaller and more depressed centra and less developed spines; the spine is obsolete on the third caudal.

MEASUREMENTS.

Atlas, length	.037
" width	.063
Axis, length of centrum	.030
" width of anterior face	.034
" height of neural spine	.046
Third cervical, length of centrum	.021
" " width of anterior face	.016
" " " over prezygapophyses	.029
Fourth cervical, length of centrum	.020
" " width of anterior face	.015
Anterior thoracic, length of centrum	.021
" " width of anterior face	.021
" " " over transverse processes	.052
" " height of neural spine	.042
" " width of spine at base	.021
" " " " " " tip	.018
Last thoracic, length of centrum	.026
" " width of anterior face	.032
" " height of neural spine	.052
First lumbar, length of centrum	.026
" " width of anterior face	.034
Second lumbar, length of centrum	.027
" " width of anterior face	.034
Second lumbar, width over transverse processes	.057
" " height of neural spine	.067
" " width of spine at base	.027
" " " " " " tip	.026
Third lumbar, length of centrum	.029
" " width of anterior face	.036
Fourth lumbar, length of centrum	.027
" " width of anterior face	.037
Sacrum, length	.177
" width of anterior face	.041
" " " posterior face	.036
First caudal, length of centrum	.022
" " width of anterior face	.032
" " " over transverse processes	.103
Second caudal, length of centrum	.022
" " width of anterior face	.031
" " " over transverse processes	.082
Third caudal, length of centrum	.022
" " width of anterior face	.027
" " " over transverse processes	.065
? Fourth chevron, dorso-ventral height	.025

Pelvis.—The pelvis differs in several respects from that of *Hapalops;* the ilium has a longer and better defined peduncle and, consequently, a larger sacro-sciatic foramen, while the anterior expansion is more gradual. The dorsal branch of the ischium is very short and depressed, broadening abruptly behind the acetabulum, thus making the peduncle extremely short, and the tuberosity is quite prominent; the ventral portion of the ischium is relatively much longer than in *Hapalops*, so that the principal diameter of the obturator foramen is dorso-ventral, instead of antero-posterior. The pubis is a slender rod, which is considerably longer and less oblique than in *Hapalops*, and the symphysis, which is formed by both pubes and ischia, is quite elongate. Owing to the length of the pubes and ischia the pelvic opening has a different shape from that of the last named genus, the dorso-ventral diameter exceeding the transverse.

MEASUREMENTS.

Pelvis, length	.283
Ilium, length	.184
Ischium, length	.109
Acetabulum, antero-posterior diameter	.051
" dorso-ventral diameter	.039
Obturator foramen, antero-posterior diameter	.055
Obturator foramen, dorso-ventral diameter	.073
Pelvic opening, dorso-ventral diameter	.117
" " transverse diameter	.095
Sacro-sciatic foramen, length	.061

Hind-Limb.—The bones of the hind-leg differ considerably from those of *Hapalops*. The femur (Plate XLIX, fig. 3), which has been considerably distorted by pressure, is of nearly the same length as in *H. longiceps*, but is notably more slender and less flattened; the large, hemispherical head rises well above the level of the great trochanter and presents more proximally, less directly inward; the sulcus for the round ligament is a deep pit of elongate, narrow oval shape; the great trochanter is heavy, but not prominent and the digital fossa is almost obsolete, while the third trochanter is distinctly smaller than in *H. longiceps*. The shaft is more rounded and slender than in any other of the Santa Cruz Gravigrada, except *Schismotherium*. The rotular groove is short and narrow.

The tibia (Plate XLIX, figs. 4, 4*a*) has a much more massive cnemial process than that of *H. longiceps*, and the shaft is more slender, more compressed antero-posteriorly and broadens less distally. A noteworthy difference from all the known contemporary Gravigrada consists in the absence of the prominent process, with its deep tendinal sulcus, from the inner side of the distal end, and the internal malleolus is quite obsolete; the astragalar surface is narrower, but deeper planto-dorsally than in

Hapalops; the intercondylar ridge is more prominent and the internal facet less concave.

The fibula resembles that of *H. longiceps*, but has a more trihedral and more uniform shaft, which is less thickened proximally and narrower distally; the distal end is extremely massive.

Measurements.

Femur, length from head	.218
" " " great trochanter	.215
" width of proximal end	.065
" " " distal end over tuberosities	.074
" " " " " " condyles	.063
" " " rotular groove	.035
Tibia, length	.160
" width of proximal end	.066
" thickness of proximal end	.057
Tibia, width of shaft in middle	.024
" thickness of shaft in middle	.018
" width of distal end	.043
" thickness of distal end	.029
Fibula, length	.144
" width of proximal end	.020
" thickness of proximal end	.023
" width of shaft in middle	.011
" thickness of shaft in middle	.011
" width of distal end	.025
" thickness of distal end	.025

The pes (Plate XLIX, fig. 5) departs in some noteworthy respects from that of *Hapalops*. The astragalus is slightly longer and narrower than that of *H. longiceps;* the trochlea is less grooved and the inner condyle less prominent, while the outer one is more so; the sulcus which invades the trochlea from the distal end is broader and much more extended dorsally; the external calcaneal facet is somewhat smaller and less concave, while the inner one is larger and separated from the former by a broader sulcus; the neck is longer and more oblique, inclining much more strongly toward the tibial side; the head is narrower transversely and thicker planto-dorsally.

Unfortunately, the calcaneum is so broken that little can be determined with regard to it; it is plain, however, that the proximal expansion of the tuberosity is much more gradual than in *Hapalops* and that the two astragalar facets are much more widely separated. The navicular is very like that of *Hapalops*, but is even shorter proximo-distally and its outer surface for the astragalus more convex. The entocuneiform is long, narrow and scale-like; the proximal end is the widest part and bears an oblique, concave facet for the navicular; at the distal end it becomes narrower and much thicker and articulates extensively with metatarsals I and II.

The mesocuneiform is even shorter, but broader and thicker than in *Hapalops*. The ectocuneiform is also shorter and has a relatively narrower navicular facet. The cuboid is smaller than in *H. longiceps* and has a smaller surface for the astragalus; the calcaneal facet is oblique and convex; the distal end is divided into a larger facet for the fifth metatarsal, and a smaller one for the fourth (a very unusual arrangement), the two separated by a distinct groove. A large plantar sesamoid is present.

The most peculiar part of the hind-foot and that which differs most from *Hapalops*, is the metatarsus, which, as in all other known contemporary Gravigrada, consists of five members. Metatarsal I is much stouter than in *H. longiceps;* it is considerably longer on the plantar than on the dorsal side, where it is cut away by the long, sloping facet for the entocuneiform; the shaft is short, broad and thick, and the distal trochlea has an unusually prominent carina, which is greatly extended planto-dorsally.

Metatarsal II, though short and stout, is somewhat longer and more slender than in *H. longiceps;* the proximal end is broader, overlapping I and III more extensively; the distal end is remarkable for the immense carina, which projects far in front of and behind the shaft.

Metatarsal III is the heaviest and, except I, the shortest of the series; the proximal end is somewhat broader than in the last named species and the extremely short shaft is much more constricted below this proximal expansion, broadening again almost immediately to form the distal end; the carina has an even more exaggerated development than that of II.

Metatarsal IV is heavier and much shorter than in *Hapalops*, not greatly exceeding II in length, and diverges less from III toward the fibular side; the proximal end has a less oblique and much narrower facet for the cuboid; the shaft is longer and more slender than in any of the preceding metatarsals and the distal carina, though very large, is less prominent than in II or III.

Metatarsal V is considerably damaged, but is obviously shorter and heavier than in *Hapalops;* the proximal end has a broader cuboid facet, but, apparently, no such great wing-like process from the fibular side as characterizes *Hapalops*, *Megalonyx* and *Nothrotherium*, while the distal trochlea is much better developed and has a more prominent carina.

Comparing the pes of the present species with that of *Hapalops*, *H. longiceps* for example, one is immediately struck by the fact that in the former the foot is more isodactyl, there being no such great difference in the length of the various metatarsals as in the latter, and, owing to the arrangement of the tarsal bones, all five of the metatarsals have their distal ends on nearly the same transverse line. This gives to the whole foot a distinctly different appearance, since there is no such marked contrast in length and thickness between II and III, on the one hand, and IV and V, on the other.

The phalanges are preserved only in connection with the three external digits and of these only IV has the ungual. The proximal phalanx is shaped much as in *H. longiceps*, but the median groove of the distal trochlea is far deeper; this phalanx is heaviest in digit III and very small in V. The second phalanx of digit III is very heavy, much longer than in the last named species and has a much more extensive and more deeply grooved distal trochlea, which describes more than a semicircle and projects freely in front of and behind the shaft; in digit IV this phalanx is longer and much more slender, while in digit V it is of similar shape, but very much smaller, the first and second phalanges together being hardly longer than the proximal one alone of digit IV. Unfortunately, the only ungual phalanx preserved, that of digit IV, is not represented in the type of *H. longiceps;* however, in the latter the ungual of digit II is present and it may be assumed that that of IV was not very different. In *A. giganteus* the ungual of IV is considerably longer than the ungual of the second digit in the last named species, and especially the portion distal to the subungual process is more slender and laterally compressed, more decurved and sharply pointed; the subungual process is not so prominent, but longer proximo-distally, extending to the edge of the trochlea.

MEASUREMENTS.

Astragalus, length	.044
“ width of trochlea	.028
“ “ “ distal end	.023
Calcaneum, width at constriction	.0195
Navicular, length on tibial side	.014
“ “ “ fibular side	.004
“ width	.026
“ thickness	.029
Metatarsus, width of proximal end	.068
Digit IV, length	.125
Metatarsal I, length	.022
“ “ proximal width	.008
“ “ “ thickness	.019
“ “ distal width	.009
“ “ “ thickness	.018
Metatarsal II, length	.037
“ “ proximal width	.019
“ “ least width of shaft	.012
“ “ distal width	.015
Metatarsal III, length	.029
“ “ proximal width	.024
“ “ least width of shaft	.017
“ “ distal width	.0085
Metatarsal IV, length	.034
“ “ proximal width	.014
“ “ “ thickness	.020
“ “ least width of shaft	.011
“ “ distal width	.0135
Metatarsal V, length	.034
“ “ proximal width	?.016

MEASUREMENTS.

Metatarsal V, proximal thickness	.019
First phalanx, digit III, length	.020
" " " " prox. width	.016
" " " " " thickness	.024
" " " " distal thickness	.019
First phalanx, digit IV, length	.016
" " " " prox. width	.013
" " " " distal width	.011
" " " " " thickness	.014
First phalanx, digit V, length	.011
" " " " prox. width	.009
" " " " " thickness	.015
" " " " distal thickness	.007
Second phalanx, digit III, length	.030
" " " " prox. width	.015
Second phalanx, digit III, prox. thickness	.019
" " " " distal thickness	.020
Second phalanx, digit IV, length	.031
" " " " prox. width	.012
" " " " " thickness	.019
" " " " distal thickness	.0165
Second phalanx, digit V, length	.018
" " " " prox. width	.008
" " " " " thickness	.013
" " " " distal thickness	.008
Ungual, digit IV, length	.061
" " " proximal width	.013
" " " " thickness	.021

Relationships.—As remarked above, it is a matter of some uncertainty whether the two species referred to *Analcimorphus* really belong to the same genus; probably they do and almost certainly they are very closely allied, if not congeneric. In what follows, however, attention will be confined to *A. giganteus*, because of the relatively full information concerning that species which we possess. The entire structure of the skeleton shows that the present species is a member of the *Megalonychidæ* and, in particular, that it is nearly connected with *Schismotherium* and *Pelecyodon.* At the same time, there are many points of resemblance to the *Planopsidæ*, to which group Ameghino has referred the genus; the dentition, several characteristic features of the skull and the proportions of the pelvis present the most obvious of these approximations to the *Planopsidæ.* To a certain extent, therefore, the present genus is a connecting link between the two families, although it cannot itself be placed in the line of descent, because it is contemporaneous with the differentiated *Planopsidæ;* it should, on the contrary, be regarded as a derivative of the common ancestor of both families and so little removed from that ancestor as to indicate its probable character.

SCHISMOTHERIUM Ameghino.

(Plates L, LI, LIII, Figs. 1, 8.)

Schismotherium Amegh.; Enumeracion sistematica, etc.; 1887, p. 21.
Metopotherium Amegh.; Rev. Argent. de Hist. Nat.; T. I. 1891, p. 324.

The diastemata are either absent or extremely short, which immediately distinguishes this genus from both *Hapalops* and *Analcimorphus*, and in fact, with the exception of *Pelecyodon*, this is the only genus of the family so characterized. The caniniform teeth vary greatly in size and shape, but they are never large and are usually more or less trihedral in section; $^{\underline{1}}$ is somewhat removed from the anterior border of the maxillary, though not nearly so far as in *Analcimorphus;* $^{\underline{2}}$ is always styliform and either cylindrical or trihedral; the molariform teeth are transversely oval and more or less compressed antero-posteriorly, sometimes very strongly.

The skull is short and broad, with much vaulted cranium and deep postorbital constriction; the sagittal and occipital crests are better developed than in most of the preceding genera and the former curves forward dorsally in a very characteristic way. The mandible is short, with deep horizontal ramus and broad ascending ramus; the symphysis is short and steep, the chin very abrupt and the predental beak short and broader than in any of the other genera.

The fore-limb and foot are of the type common to all the family, but the manus is more isodactyl than in *Hapalops*. The femur is remarkable for the slenderness and roundness of the shaft, which are even more pronounced than in *Analcimorphus*.

While more complete material of this genus is much to be desired, the evidence at hand is sufficient to show that in *Schismotherium* we have the somewhat modified representative of one of the most primitive members of the Gravigrada and one which is not far removed from the common ancestor of all the *Megalonychidæ* and perhaps of the other two families also, as may be seen from the styliform $^{\underline{2}}$, the slender femur and the isodactyl feet; it is a very suggestive fact that in the Gravigrada of the Patagonian formation $^{\underline{2}}$ is almost always styliform, and probably the absence of diastemata is also a primitive feature, but conclusive evidence on this point is lacking. The close relationship of *Schismotherium* with *Analcimorphus* is very clear, and through the latter we have the connection with the *Planopsidæ*.

SCHISMOTHERIUM FRACTUM Ameghino.

(Plates L; LI, Figs. 1, 4, 4*a*; LIII, Figs. 1, 8.)

Schismotherium fractum Amegh.; Enumeracion sistematica, etc.; 1887, p. 21.

In the Princeton Museum this species is represented by two skulls (Nos. 15,344, 15,524), a mandible without teeth (No. 15,361) and by a left ramus mandibuli, with the teeth in place (No. 15,901), all of which were obtained by Messrs. Hatcher and Peterson at Killik Aike. In addition to this there is in the Ameghino collection a fine skull, with mandible and fore-limb nearly complete, while the type-specimen in the La Plata Museum is sufficiently characteristic for the satisfactory identification of other specimens.

In both upper and lower jaws the teeth form almost continuous series, though short interspaces divide them, slightly longer between $\underline{1}$ and $\underline{2}$; $\underline{1}$ is quite small, caniniform, laterally compressed and narrow, plane on the inner and convex on the outer side and with obliquely truncate masticating surface; $\underline{2}$ has the styliform character which is so constant in all this group of genera; in the present species it is usually subcylindrical or slightly oval, with principal diameter antero-posterior; $\underline{3}$, the largest of the series, is transversely oval; $\underline{4}$ and $\underline{5}$, also oval, diminish successively in size. In the mandible $\overline{1}$ approximates an equilateral triangle in section, but is sometimes very small and subcylindrical; $\overline{2}$ and $\overline{3}$ are transversely elliptical and of nearly equal size, and $\overline{4}$ is usually cylindrical, but may be oval like $\overline{3}$, though always less compressed antero-posteriorly.

MEASUREMENTS.

	No. 15,344.	*No. 15,524.*
Upper dentition, length	.039	
" " " $\underline{2}$–$\underline{5}$	.031	.031
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.007	
" width (*i. e.*, transverse diameter)	.005	
$\underline{2}$, length	.008	.008
" width	.007	.007
$\underline{3}$, length	.009	.006
" width	.011	.011
$\underline{4}$, length	.006	.006
" width	.009	.010
$\underline{5}$, length	.006	.0055
" width	.007	.008

MEASUREMENTS.

	No. 15,361.	*No. 15,901.*	*Amegh. Coll.*
Lower dentition, length	.031	.033	.032
" " " $\overline{2}$–$\overline{4}$	.024	.024	.024
$\overline{1}$, length	.006	.0065	.008
" width	.005	.0045	.006
$\overline{2}$, length	.007	.006	.006
" width	.009	.009	.010
$\overline{3}$, length	.008	.0065	.006
" width	.010	.010	.010
$\overline{4}$, length	.009	.0075	.008
" width	.009	.009	.008

N. B. Some of the discrepancies in this table are due to the fact that in No. 15,361, and No. 15,344, except in the case of $\underline{4}$, the dimensions are taken from the empty alveoli.

The skull (Plates L; LI, fig. 4), though varying considerably in different individuals, is one of the most characteristic in the entire series of Santa Cruz Gravigrada; its appearance is much changed in those individuals which have undergone even a slight amount of vertical compression, which diminishes the remarkable elevation and vaulting of the cranium (compare figs. 1 and 2, Pl. L). This skull is peculiar in its low occiput, high and dome-like cranium, short and deep postorbital constriction, broad forehead and short, wide rostrum. The upper contour is quite sinuous; it rises more or less steeply to the parietal eminence, which is somewhat farther forward than the glenoid cavity; from this point, the line, sometimes concave, descends to the postorbital constriction, becoming convex over the forehead and descending gently to the end of the rostrum. Seen from above, the aspect of this skull is equally characteristic, the anteriorily inclined occipital crest curves forward in the middle dorsal region, invading the roof of the cranium; the short postorbital constriction is deep and abrupt, the skull rapidly broadening again to the forehead, which has temporal ridges that are much more prominent in some individuals than in others; the lachrymals are only moderately prominent and the preorbital fossæ are not visible from above; the rostrum is short, narrowing slightly forward, blunt at the end and somewhat decurved, recalling the shape seen in many rodents.

The occipital surface, which has a forward inclination, is broad and unusually low; the ventral portion is transversely convex and is produced outward above the foramen magnum, giving the latter a tubular form, while the dorsal portion is convex on the sides, with a broad, shallow median concavity, where it extends forward between the parietals; laterally, the occipital crest is prominent, rugose and heavy, dorsally it curves forward around the median concavity already mentioned and becomes very much thinner, but remains distinct and clearly demarcates the supraoccipital from the parietals; the condyles are small and sessile, projecting little behind the plane of the occiput and rather more below the cranial axis.

The basioccipital is long, broad, and concave transversely, with a shallow, median depression, which deepens forward; the paroccipital processes vary much, as they may be entirely absent, or unusually prominent. A narrow strip of the periotic is exposed on the surface, ending ventrally in the usual, cylindrical mastoid process, with its facet for the stylo-hyal. The basisphenoid is broad and nearly plane, except posteriorly, where it is concave; both this bone and the presphenoid are left largely exposed by the pterygoids; the orbito-sphenoid, which is quite large, is deeply impressed by a fossa, into which the spheno-palatine, optic and anterior lacerated foramina open.

The parietals are large, but not very long, and support a sagittal crest, which is low and thin, especially over the parietal eminence. The squamosal is relatively small; it forms a considerable part of the occipital crest, the ventral end of which is thickened into the usual tubercle; no distinct posttympanic process is present; the zygomatic process is short and slender and is bent outward so abruptly that its posterior end forms a distinct angulation with the cranial wall. The lachrymals have the shape common to this group, but are rather smaller and less prominent than usual, an appearance which is due to the shortness of the zygomatic processes of the maxillaries and to the breadth of the rostrum; the foramen proper is small, but a wide, funnel-shaped depression leads into it.

The frontals have the ordinary hour-glass form, which is exaggerated by the depth and abruptness of the postorbital constriction; the forehead is short, broad and nearly flat; the sagittal crest, which extends over half the frontals, bifurcates into low temporal ridges, which curve abruptly outward and end in obscure angulations, the postorbital processes; ventrally, the frontals are strongly incurved and take part in the fossæ into which the anterior cranial foramina open; the nasal suture is a narrow and deep emargination of the frontals, producing a short nasal process on each side. The nasals are long and narrow and quite convex in both directions; they are narrowest at the frontal suture and, broadening regularly forward, are widest at the anterior end; there is no lateral notch or process, but each nasal is obliquely truncated, so as to form a short, blunt, median point. The premaxillaries are not known, but the facets for them upon the maxillæ indicate that they probably resemble those of *Hapalops* in shape, except for their extreme shortening. The preorbital portion of the maxillaries is rather long, owing to the posterior position of the orbit; the preorbital fossa is usually small and shallow, though it is sometimes well defined, and is always very narrow; the dorsal portion of the maxillary is incurved and forms much of the roof of the nasal chamber; the zygomatic process of the maxillary is much less prominent than in *Hapalops* and the infraorbital foramen is narrow, hardly more than a slit. The bony palate and posterior nares show no important differences from those of the latter genus.

The cranial foramina differ from those of *Hapalops* in only a few particulars; the optic foramen is placed lower down and nearer to the foramen lacerum anterius, which is farther removed from the united foramina rotundum and ovale; the glenoid foramen appears to be wanting, and the venous foramina along the parieto-squamosal suture are few and inconspicuous.

The mandible has a very short, deep and thick horizontal ramus, with strongly convex ventral border; the predental beak is very short and at the anterior end is broader than in any of the preceding species; the symphysis is very short and the chin almost vertical. The ascending rami are convex externally and concave internally, a peculiarity which is not repeated in any other contemporary genus; the anterior border of the ascending ramus is quite broad at the base and is made concave by the prominence of the linea obliqua interna; the coronoid, which varies much in height, is incurved, recurved and bluntly pointed, and the sigmoid notch is narrow and shallow; the condyle is set upon a long neck and is curved mesially, presenting inward almost as much as upward; of the angle only enough is preserved to show that it was inflected. The postero-external opening of the dental canal is at the base of the linea obliqua externa; the mental foramen is single and presents forward.

MEASUREMENTS.

	Amegh. Coll.	*No. 15,344.*	*No. 15,524.*
Skull, length in median basal line		.099	
“ “ condyle to anterior nares	.120	.118	
Cranium, length to edge of orbit	.100	.094	.089
Face, length orbit to anterior nares	.024	.025	
Skull, width at zygomatic processes		.047	.048
“ “ “ postorbital constriction		.029	.030
Occiput, height	.041	.035	.039
“ width at base		.047	.051
Zygomatic arch, length		.070	
Palate, length in median line		.042	
“ width at $\underline{1}$		.019	
“ “ “ $\underline{2}$		.014	.016
“ “ “ $\underline{5}$		.0115	.012

	Amegh. Coll.	*No. 15,391.*	*No. 15,901.*
Mandible, length from condyle	.075		
“ “ of predental beak	.014		
“ depth below $\overline{3}$	.026	.024	.029
“ thickness below $\overline{3}$		.013	.015
“ depth behind $\overline{4}$	.021	.019	.023
“ height of coronoid	.053	.050	

A specimen (No. 9,244, Plate LIII, fig. 8) in the American Museum of Natural History, consisting of the last two thoracic vertebræ, the entire lumbar series, sacrum and pelvis, may be provisionally referred to this species. It may, however, be assignable to a large species of the nearly allied genus *Pelecyodon*. The two thoracic vertebræ have short but heavy centra, with small foramina opening on the ventral side, very short neural spines, which are strongly inclined backward and thickened at the tip, especially on the penultimate vertebra; the very short transverse processes bear facets for the rib-tubercles, even on the last thoracic; accessory articular processes are found only in the form of a pair of small additional postzygapophyses on the last vertebra, a very marked contrast to *Hapalops;* the metapophyses also are much smaller than in the latter.

There are five lumbars, a larger number than has been observed in any other contemporary species of the Gravigrada. The centra of these vertebræ increase in length to the third and then diminish, but become broader and more depressed to the last; the ventral foramina are conspicuous on all of them, despite the completely adult state of the animal, and are especially large on the second and fifth. The neural spines are remarkably different from those of *Hapalops*, being very much lower, narrower and more inclined, each one overhanging the vertebra behind it, and much thickened at the free end; the transverse processes also are much shorter than in the last named genus and are more elevated, projecting obliquely upward; except on the first lumbar, they are very broad and are somewhat thickened at the distal end. The accessory zygapophyses are of the type common to all the family and the metapophyses are small.

The sacrum consists of five vertebræ and its only noteworthy feature is the fact that the ridge formed by the coalesced neural spines is very low.

The pelvis is very similar to that of *Hapalops*, with a few minor differences. Thus, the ilium has a somewhat more concave gluteal surface, which presents more obliquely and less dorsally; the sacro-sciatic foramen is larger, especially in the dorso-ventral diameter; the pubis and descending process of the ischium are longer, making the posterior pelvic opening higher and narrower, and the obturator foramen is larger and of a more oval shape.

MEASUREMENTS.

Last thoracic, length of centrum	.018
" " width of anterior face	.022
" " width over transverse processes	.040
" " height of neural spine	.028
" " width of spine at tip	.013
Lumbar region, length	.144
First lumbar, length of centrum	.018
" " width of anterior face	.023
" " width over transverse processes	.061
" " height of neural spine	.030
" " width of spine at tip	.016
Third lumbar, length of centrum	.022
" " width of anterior face	.025
" " width over transverse processes	.052
Third lumbar, height of neural spine	.030
" " width of spine at tip	.020
Fifth lumbar, length of centrum	.021
" " width of anterior face	.026
" " width over tranverse processes	.070
" " height of neural spine	.027
" " width of spine at tip	.021
Sacrum, length	.105
First sacral, width of anterior face	.030
Last sacral, width of posterior face	.025
Pelvis, length	.204
" greatest width	.208
Ilium, length	.128
" greatest width	.079
Ischium, length	.076
Posterior pelvic opening, width	.081

In the Ameghino collection is a well preserved fore-leg and foot; the bones resemble those of *Hapalops*, with certain minor differences. The humerus is of nearly the same length as that of *H. elongatus*, but somewhat heavier, and the deltoid area is distinctly less prominent, while the internal epicondyle and supinator ridge are better developed. The radius is so like that of the latter as to require no description.

The manus, which has been figured by Ameghino ('98, fig. 69), differs from that of *Hapalops* in a number of details. The scaphoid is even shorter proximo-distally, especially on the radial side; it appears not to touch the magnum at all, though it is difficult to make quite certain of this. The lunar is shorter and its exposed dorsal face is more regularly quadrate; it does not extend below the pyramidal and apparently does not touch the unciform. The pyramidal is somewhat longer and more cubical; the magnum is larger and its dorsal face is more regularly pentagonal, while the unciform is longer and hardly so deeply notched for metacarpal III.

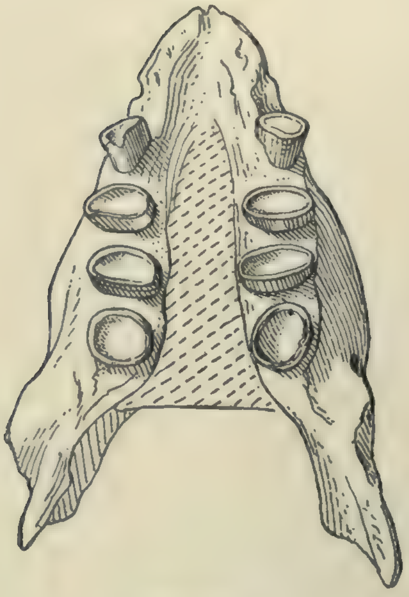


FIG. 35.

Schismotherium fractum. Mandible, crown-view, × $\frac{1}{1}$. Amegh. Coll.

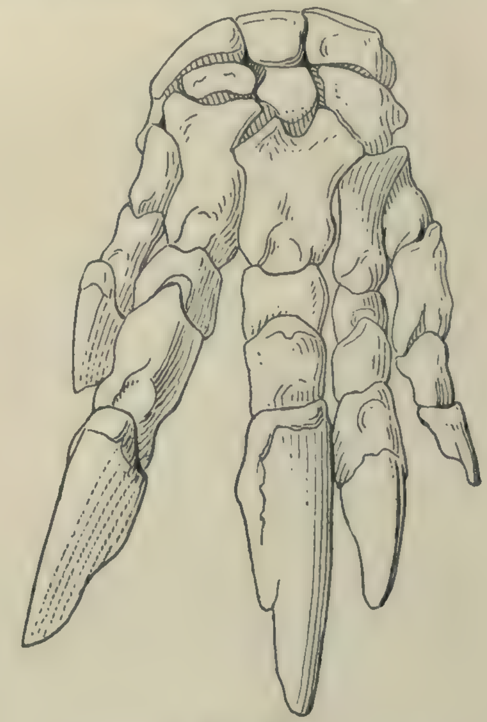


FIG. 36.

Schismotherium fractum. Left manus, × $\frac{1}{1}$. Amegh. Coll.

In the metacarpus the most obvious difference from *Hapalops* is the more equal length of metacarpals II, III and IV, the distal ends of which lie in nearly the same transverse line, while in the latter genus the line connecting the distal ends of the same three metacarpals is very oblique, owing chiefly to the great elongation of IV. Metacarpal I is the shortest of the series and quite stout; II is relatively shorter and heavier than in *Hapalops*, and III is not only heavier, but also has a far more massive process which abuts against the unciform. Metacarpal IV is much more slender than II or III and somewhat shorter, a marked difference from *Hapalops;* V also is much shorter than in the latter and a little stouter in proportion.

The phalanges of the first and second rows differ very little from those in the last named genus, but the unguals are broader at the proximal end, less compressed and not so sharply pointed; in order of size the arrangement would be, III, II, IV, I, V.

Associated with the skull, No. 15,524, was found the proximal half of a femur (Plate LIII, fig. 1), so unlike that of the other Santa Cruz Gravigrada as to raise a suspicion that the association was accidental. However, the femur of *Analcimorphus* serves to connect that referred to *Schismotherium* with the usual gravigrade type.

The head is hemispherical, set upon a distinct neck, rising far above the great trochanter and presenting proximally more than internally; its surface is smooth, without sulcus for the round ligament; the great trochanter is low and massive and, on the posterior side, it forms a broad, elongate ridge, enclosing a very small digital fossa; the second trochanter is a prominent, heavy and rugose tubercle, and the third is also very prominent. Aside from the shape and position of the head and the absence of the pit for the round ligament, the great peculiarity of this femur is in the form of the shaft, which is not antero-posteriorly compressed and flattened, as it so universally is among the Gravigrada, but tends to the cylindrical shape common to most mammals.

MEASUREMENTS.

Humerus, length	.138	Metacarpal II, length	.021
“ width of proximal end	.037	“ “ width of proximal end	.0105
“ “ “ distal end over epicondyles	.066	“ “ “ “ distal end	.009
“ “ “ distal trochlea	.029	Metacarpal III, length	.021
Radius, length	.120	“ “ width of proximal end	.017
“ width of proximal end	.019	“ “ “ “ distal end	.010
“ “ “ distal end	.021	Metacarpal IV, length	.020
Carpus, proximo-distal length in median line	.015	“ “ width of proximal end	.006
“ width	.033	“ “ “ “ distal end	.006
Metacarpal I, length	.010	Metacarpal V, length	.012
“ “ width of proximal end	.006	“ “ width of proximal end	?.005
“ “ “ “ distal end	.006	“ “ “ “ distal end	.006
		Ungual phalanx, digit I, length	.018
		“ “ “ II “	.033

MEASUREMENTS.

Ungual phalanx, digit IV, length	.026	Femur, width of shaft above third trochanter	.030
" " " V "	.011	" thickness of shaft above third trochanter	.022
Ungual, digit III, proximal width	.010		
Femur, width of proximal end	.056		

SCHISMOTHERIUM SPLENDENS (Ameghino).

(Plate LI, Figs. 2–3^b.)

Metopotherium splendens Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 324.

In the Brown collection, American Museum of Natural History, is a representative of this species (No. 9,247) which agrees very well with the type, and consists of a skull without mandible and lacking the cranial roof, associated with the atlas, ulna and fibula. Another individual in the Princeton Museum (No. 15,590, a skull lacking the occiput, basis cranii and mandible, found by Mr. Peterson at Halliday's) is more aberrant, but almost certainly referable to the same species.

The dentition varies much in the different individuals, but, nevertheless, displays certain constant differences from that of *S. fractum*. The upper caniniform ($^{\underline{1}}$) is small, recurved, of longitudinally elliptical section and usually is obliquely worn, but in the Princeton specimen this tooth is extremely small and protruded but little below the level of the alveolus, and the exposed portion is not recurved, but straight and horizontally abraded; the great reduction of $^{\underline{1}}$ in this individual is probably a sexual character. The space between $^{\underline{1}}$ and $^{\underline{2}}$ almost deserves the name of an extremely short diastema and in all known examples is longer than in the preceding species. The second upper tooth is styliform and may be subtrihedral or subquadrate in section; the three succeeding teeth are transversely oval, diminishing in size from $^{\underline{3}}$ to $^{\underline{5}}$, which is the smallest of the molariform series. These teeth are broader and more antero-posteriorly compressed than in *S. fractum*, notably so in No. 9,247, in which this feature is exaggerated. In the subjoined table the measurements of the type are, except in the case of $^{\underline{1}}$ and $^{\underline{5}}$, taken from the empty alveoli.

MEASUREMENTS.

	Type.	*No. 9,247.*	*No. 15,590.*
Upper dentition, length	.038	.038	.038
" " " $\underline{2}$–$\underline{5}$	.030	.030	.030
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.005	.006	.004

MEASUREMENPS.

	Type.	*No. 9,237.*	*No. 15,590.*
" width (*i. e.*, transverse diameter)	.0035	.0035	.003
$\underline{2}$, length	.0075	.0063	.0063
" width	.0065	.006	.0065
$\underline{3}$, length	.008	.006	.0063
" width	.010	.0105	.010
$\underline{4}$, length	.0065	.006	.0055
" width	.0095	.010	.009
$\underline{5}$, length	.0035	.005	.005
" width	.007	.009	.008

The skull has certain constant differences from that of *S. fractum*. As in the latter, the occiput is low and from it the upper contour of the skull rises quite steeply to the parietal eminence, though the cranium is never so high and dome-like as it often is in *S. fractum*; from the eminence the profile decends very gradually and almost uninterruptedly to the end of the rostrum. The characteristic difference from the skull of the preceding species is best displayed when the skull is viewed from above; it is then seen to have a narrower and more elongate cranium, with much better defined sagittal crest and temporal ridges, longer, shallower and less abrupt postorbital constriction, shorter and less tapering rostrum. The occipital surface is relatively narrower than in *S. fractum*, with thinner and less prominent crest, which, though curved forward between the parietals, does not form so deep an embayment; the foramen magnum is more circular and the condyles less sessile. The parietals are relatively broader and the squamosal is narrower, and its zygomatic process even shorter.

A fragment of the jugal is connected with No. 9,247 and differs in some respects from that of any other Santa Cruz species in which this element is known, displaying a curious resemblance to the jugal of *Glossotherium* as figured by Reinhardt ('79, Tab. I); the anterior end is broadened into a hammer-like head for articulation with the maxillary and lachrymal, then, for a short distance, the bone becomes very slender, expanding again into the plate-like suborbital process, which is narrower than in *Glossotherium*, but has similar raised borders, with a depression between; the posterior part of the jugal must have been longer than in the Pleistocene genus, as is shown by the zygomatic process of the squamosal.

The frontals have less of the hour-glass shape than in *S. fractum*, owing to the shallowness of the postorbital constriction; they have a shorter, wider sagittal crest and much more prominent temporal ridges; anteriorly, the frontals are less deeply emarginated by the nasals and the nasal processes are extremely short; the forehead is narrower, longer, more lozenge-shaped and very gently concave. The nasals are shorter and of a slightly different shape; posteriorly they are broader and less pointed and are throughout of more uniform width, though the anterior ends are slightly broadened, extending somewhat beyond the maxillaries, and have very wide, shallow notches, with hardly perceptible median point. The maxillaries have better defined and larger preorbital fossæ than in *S. fractum* and the median notch of the palate for the premaxillary spines is broader and shallower; the palate is somewhat narrower and more convex behind than in the latter species and widens more anteriorly.

MEASUREMENTS.

	Type.	*No. 9,247.*	*No. 15,590.*
Skull, length in median basal line	.100	.101	
" " condyles to anterior nares	.118	.119	
Cranium, length condyle to anterior edge of orbit	.093	.095	
Face, length orbit to anterior nares	.027	.027	.026
Cranium, width at zygomatic processes	.051	.044	.044
" width at postorbital constriction	.033	.029	.030
Occiput, width at base	.046	.046	
Rostrum, width at infraorbital foramen	.030	.032	.031
" " " anterior end	.025	.027	.028
Zygomatic arch, length	.065	.066	
Palate, length in median line		.040	.039
" width at $\underline{1}$		.021	.019
" " " $\underline{2}$	.015	.014	.014
" " " $\underline{5}$	.012	.0095	.011

The atlas is higher and narrower proportionately to length than in *Hapalops;* the anterior cotyles are very small and are given a kidney-shape by a sulcus which invades each from the mesial side, and the posterior cotyles are extremely narrow; the neural arch is broad, thin and strongly upcurved, making the canal very high, and has no spine; the inferior arch is narrower, straighter and without hypapophysis.

The ulna is relatively longer and more slender than in *Hapalops* and has a shorter olecranon and shallower sigmoid notch; the shaft is straighter and the distal end larger, with a projection for the radius which is not present in the genus last named.

The fibula is remarkable for the antero-posterior extension of the proximal end and the large size of the tibial facet; the shaft is laterally compressed and of almost uniform diameter, except near the distal end, where it is much enlarged; the distal end is very heavy, less elongate than in *Hapalops*, with notably smaller tibial and more nearly plane astragalar facet.

MEASUREMENTS.

Atlas, length	.022	Fibula, length	.114
" dorso-ventral height	.026	" thickness of proximal end	.023
Ulna, length	.141	" width of shaft in middle	.0065
" " of olecranon	.015	" thickness of shaft in middle	.0095
" width of humeral trochlea	.019	" width of distal end	.020
" " " distal end	.0125	" thickness of distal end	.025

PELECYODON Ameghino.

(Plates LII, LIII, Figs. 2 7.)

Pelecyodon Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 323.
Uranokyrtus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 159.
Adiastemus Amegh.; Ibid, p. 160.

Although closely allied with *Schismotherium*, *Pelecyodon* is a well distinguished genus. The dentition is especially characterized by the shape of the upper caniniform, which is much compressed laterally and extended antero-posteriorly and is plane on the inner, convex or angulate on the outer face; in some examples this tooth is abraded only on the posterior face, in others it is bevelled to a sharp point; it is inserted somewhat nearer to the anterior edge of the maxillary than in the preceding genus. The teeth are implanted in nearly continuous series, but with slightly longer interspace between $\frac{1}{}$ and $\frac{2}{}$ than between the succeeding teeth. The second upper tooth, $\frac{2}{}$, is more or less cylindrical, but rather narrower in front than behind; $\frac{3}{}$, $\frac{4}{}$, and $\frac{5}{}$ are transversely oval, $\frac{3}{}$ the largest and $\frac{5}{}$ much the smallest of the series. In the lower jaw, $\frac{}{1}$ is small, laterally compressed and of elliptical or obscurely trihedral section, and is separated from $\frac{}{2}$ by an even shorter space than that between $\frac{1}{}$ and $\frac{2}{}$; $\frac{}{2}$ and $\frac{}{3}$ are transversely oval and $\frac{}{4}$ is subcylindrical.

The skull is longer and narrower than in *Schismotherium*, but the orbit is slightly more advanced and the face is therefore somewhat shorter; the sagittal crest is well defined and the occipital crest is thin, but more or less prominent, and its median dorsal portion is but slightly curved forward, a marked and constant difference from the preceding genus. The mandible has a short horizontal ramus and a short predental beak, which is narrower and more pointed than in *Schismotherium*. Ameghino has called attention to a remarkable feature of the mandible in this genus and its allies, viz., the division of each horizontal ramus into two elements which are suturally connected. "En outre, dans certains genres (*Pelecyodon*, *Metopotherium*, etc.) les branches mandibulaires sout formées par deux pièces distinctes, une antérieure et l'autre postérieure; ces deux pièces sont unies par une suture qui part du bord alvéolaire, à peu près vers la moitié de la longeur de la série dentaire, et se dirige obliquement en arrière et en bas pour se terminer dans le bord inférieur à peu près au-dessous de la dernière dent. Cette suture, qui sans doute est un caractère hérité des reptiles, disparaît de bonne heure; pourtant, dans quelques espèces, elle est persistante" ('94^a, 141; 160, fig. 1). It is true that an appearance of such a suture may be observed in certain mandibles, but the appearance is not conclusive or convincing. At all events, it cannot well be an inheritance from the reptiles, for in that group the dentary bone is not divided.

The skeleton of the present genus is incompletely known and only in connection with *P. arcuatus*. The cervical vertebræ are small and lightly constructed, otherwise differing little from those of the smaller species of *Hapalops*. The trunk vertebræ are remarkable for the short, slender, backwardly directed neural spines, which are of curiously uniform length and thickness throughout the series, though becoming somewhat longer in the posterior thoracic and lumbar regions. The humerus resembles that of *Hapalops*, except that the deltoid area is less developed than in any of the other known Santa Cruz Gravigrada; the ulna is short and slender and in the manus digits IV and V are more reduced than in any other contemporary genus of the order. The femur differs from that of *Analcimorphus* and *Schismotherium* in having the broad, antero-posteriorly compressed shaft, but has an unusually small third trochanter; the tibia resembles that of *Hapalops*, except that the astragalar surface is nearly plane. The pes is remarkable for the great size and thickness of digit III, which has a relatively enormous claw; as in *Analcimorphus*, metatarsal IV is but little longer than II and III, while V is much reduced and has no such process from the fibular side of the proximal end as characterizes *Hapalops*

PELECYODON CRISTATUS Ameghino.

(Plate LII.)

Pelecyodon cristatus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 323.

Pelecyodon robustus Amegh., Ibid.

This is a very variable species, with a considerable range of difference in size, in the proportions of the teeth, etc., but the individuals grade into one another so completely that it is impracticable to separate them. In the type-specimen $^{\underline{1}}$ is much compressed laterally, extended antero-posteriorly, forming in cross-section an elongate, very narrow oval; the grinding surface is bevelled to a sharp point by abrasion on both sides; a second individual, belonging to the La Plata Museum, appears, from the shape of the empty alveolus, to have this tooth of similar form, but somewhat broader transversely; in other individuals, again, the transverse width of the tooth is greater, the antero-posterior length is less, while the abrasion is only on the posterior side. The second upper tooth is subcylindrical, varying only in size and in the narrowness of the anterior face, which is never so broad as the posterior; $^{\underline{3}}$ and $^{\underline{4}}$ are transversely oval and $^{\underline{5}}$ is very small and may or may not be made reniform by a vertical groove on the posterior face; in the same specimen this groove may be present in $^{\underline{5}}$ of one side and not of the other. In the mandibular dentition $_{\overline{1}}$ is small and longitudinally elliptical or trihedral; $_{\overline{2}}$ and $_{\overline{3}}$ are transversely oval and $_{\overline{4}}$ is subcylindrical.

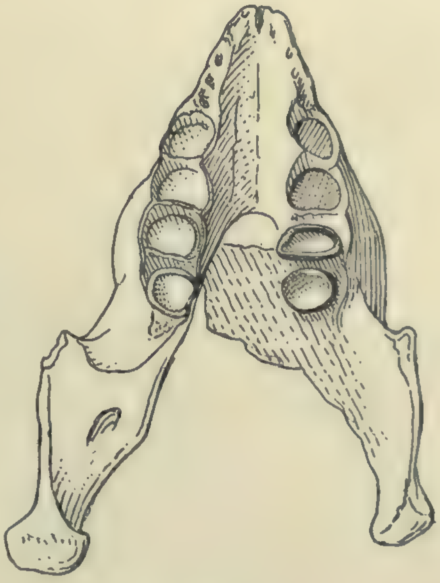


FIG. 37.

Pelecyodon cristatus. Mandible, crown-view, × $\frac{1}{1}$. Amegh. Coll.

MEASUREMENTS.

	Type.	*L. P. Museum.*	*No. 15,049.*	*No. 15,627.*
Upper dentition, length	.037	.032	.040	.035
" " " $^{\underline{2}}$–$^{\underline{5}}$	.027	.023	.030	.025
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.008	.008	.0073	.006
" width (*i. e.*, transverse diameter)	.004	.0045	.0043	.005

MEASUREMENTS.

	Type.	*L. P. Museum.*	*No. 15,049.*	*No. 15,627.*
$\underline{2}$, length	.007		.007	.006
" width	.006		.0063	.0053
$\underline{3}$, length	.0053	.005	.006	.0053
" width	.0083	.008	.009	.008
$\underline{4}$, length	.005	.005	.006	.005
" width	.0073	.0065	.0085	.0065
$\underline{5}$, length	.003	.0025	.0043	.0033
" width	.007	.005	.0073	.007

	Type.	*No. 2.*	*Type of P. robustus.*
Lower dentition, length	.028	.026	.027
" " " $\overline{2-4}$	.022	.020	.021
$\overline{1}$, length	.006	.007	.0055
" width	.002	.0035	.004
$\overline{2}$, length	.006	.005	.0055
" width	.009	.008	.009
$\overline{3}$, length	.007	.005	.0065
" width	.009	.007	.010
$\overline{4}$, length	.007	.0065	.0065
" width	.008	.0055	.008

In specimens that have not been distorted by pressure the profile of the skull resembles that of *Schismotherium splendens*, the upper contour rising even more steeply to the parietal eminence and thence descending gently and uninterrupedly to the end of the rostrum; the occiput is low, inclined slightly forward, and convex, save in the median dorsal region, where it becomes slightly concave, though very much less than in *Schismotherium* and hardly at all in some specimens; the median vertical ridge which runs from the occipital crest nearly to the foramen magnum is much more prominent in some individuals than in others; the occipital crest is well defined, but very variable in degree of prominence; the foramen magnum is small and subcircular, and the condyles are small, sessile, and projecting little behind or below the occiput; the fossa between the exoccipital and squamosal is much deeper than in *Schismotherium.* The tympanic is of the usual type, a loosely attached, incomplete ring.

The parietals differ little in their proportions from those of *Schismotherium splendens*; the sagittal crest is usually a thin ridge, but in the type-specimen its posterior portion is a narrow area, as in the last named species; the crest is continued for a considerable distance upon the frontals, dividing into faintly marked temporal ridges, which are even more obscure than in *S. fractum ;* the postorbital constriction is much shallower and less abrupt than in the latter. The squamosal is long and low and the tubercle at its infero-lateral angle is unusually prominent ; the zygomatic process is short and weak and near its base is pierced by a vascular foramen. The lachrymal is less prominent than in most of the genera. The facets for the premaxillæ on the maxillaries indicate that they were somewhat different from those of *Schismotherium ;* the surface for the postero-external branch is larger and rises higher upon the sides of the anterior nares and the notch for the spines is deeper and narrower. The preorbital portion of the maxillaries is shorter than in *Schismotherium* and the fossæ deeper than in *S. splendens ;* the bony palate is of nearly uniform width. The posterior nares differ from those of *Hapalops* in having lower side walls.

The mandible resembles that of *S. fractum* in appearance, but is lighter and more delicate ; the ventral border of the horizontal ramus is but slightly convex ; the symphysis is short and the predental beak is short, narrower and more pointed than in *S. fractum ;* the ascending ramus is very much thinner than the horizontal, producing a peculiar angulation of the jaw.

MEASUREMENTS.

	Type.	*L. P. Museum.*	*No. 15,049.*	*No. 15,627*
Skull, length in median basal line			.098	
" " condyle to anterior nares		.094	.116	.108
Cranium, length condyle to edge of orbit	.089	.080	.098	.089
Face, length orbit to anterior nares		.016	.020	.021
Occiput, height	.030	.028	.035	.034
" width at base	.039	.040		.046
Cranium, width over zygomata	.039	.039		.047
" " at postorbital constriction	.023	.024		.031
Zygomatic arch, length		.053	.069	.063
Palate, length in median line			.038	
" width at $\underline{1}$	.015	.016	.017	.019
" " " $\underline{2}$	.012	.013	.015	.013
" " " $\underline{5}$	.010	.010	.012	.012

In the La Plata Museum is a curious jaw-fragment, evidently pathological and probably referable to this species. As the result of inflammation, the horizontal ramus is swollen and pitted on the outer side and the process has given an abnormal character to $\overline{2}$. The anterior half of this tooth, which is considerably narrower than the posterior, is composed of two columns, of which the external is much larger and is placed in the median line of the tooth, with a broad shallow groove on its outer face; the internal column is very much smaller and is sharply defined by deep vertical grooves in front of and behind it; $_3$ is of the ordinary transversely oval shape, but has a distinct, vertical sulcus on the inner side; $_4$ is subcylindrical and quite normal.

PELECYODON PETRÆUS Ameghino.

Pelecyodon petræus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 323.

This species is as yet represented only by the type specimen and, although distinguished merely by the form of the teeth (usually a very uncertain criterion) is probably valid. Its peculiarities are not connected by transitional forms with the other species, but, on the contrary, give it an isolated position. On the left side, $^{\underline{1}}$ is shaped much as in *P. cristatus*, elongate antero-posteriorly and much compressed laterally, while on the right side it is relatively broader; $^{\underline{2}}$ is narrower anteriorly than in the preceding species and thus has a more trihedral form; $^{\underline{3}}$ is remarkable for its shortness antero-posteriorly and transverse width and is in marked contrast to the shape of this tooth in the other species of the genus; $^{\underline{4}}$ is smaller, but of similar, exceptionally short and broad form; $^{\underline{5}}$ is very small but relatively very wide.

The following dimensions are from a photograph of the type, right side.

MEASUREMENTS.

Upper dentition, length	.032
" " " $\underline{2}$–$\underline{5}$	.023
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.0065
" width (*i. e.*, transverse diameter)	.0035
$\underline{2}$, length	.0065
" width	.006
$\underline{3}$, length	.0045
" width	.0095
$\underline{4}$, length	.0035
" width	.009
$\underline{5}$, length	.002
" width	.006

PELECYODON ARCUATUS Ameghino.

(Plate LIII, Figs. 2–7.)

Pelecyodon arcuatus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 323.

In the collection of the American Museum of Natural History is a specimen (No. 9,240) which agrees closely with the type of this species.

It consists of the mandible, with dentition complete; four cervical, sixteen thoracic, one lumbar and two caudal vertebræ; the right scapula and humerus, left ulna and part of manus; the right ilium and femur; both tibiæ and the greater part of the pes. The skeleton is much more distinct from that of the other genera than would have been expected from the teeth and skull only.

The dentition is not especially characteristic; $_{\overline{1}}$ is very slender, of longitudinally elliptical section, with major axis somewhat oblique to the line of the other teeth, while the crown is erect and quite high. Although the alveoli of $_{\overline{1}}$ and $_{\overline{2}}$ are separated by a very thin lamina of bone, the space between the teeth themselves is greater than between any succeeding pair, because neither tooth completely fills its socket; $_{\overline{2}}$ is large, much compressed antero-posteriorly and transversely oval, with major axis oblique to the line of the dental series; $_{\overline{3}}$ is similar, but slightly larger and less oblique; $_{\overline{4}}$ is subcylindrical, especially in the type, while in 9,240 it is more of an oblique oval.

MEASUREMENTS.

	Type.	*No. 9,240.*
Lower dentition, length	.031	.031
“ “ “ $_{\overline{2}-\overline{4}}$	.022	.023
$_{\overline{1}}$, length (*i. e.*, antero-posterior diameter)		.005
“ width (*i. e.*, transverse diameter)		.004
$_{\overline{2}}$, length	.0055	.006
“ width	.010	.008
$_{\overline{3}}$, length	.007	.0065
“ width	.0095	.0085
$_{\overline{4}}$, length	.0075	.007
“ width	.0095	.009

The mandible differs in several respects from that of *P. cristatus*, especially in the much greater sinuosity of the ventral border, being more convex under the horizontal ramus and much more concave under the ascending ramus; the sudden thickening of the former at its posterior end projects more externally in *P. cristatus* and more internally in the present species; the angular process is very long and prominent, extending well behind the condyle, and is broader dorso-ventrally than in *P. cristatus;* its ventral border is but slightly inflected, much less than in the large contemporary genera. The condyle is placed upon a shorter neck than in the species last named and projects more upward, less backward; the sigmoid notch is narrower and deeper and the coronoid process is somewhat narrower and more recurved, and the postero-external opening of the dental canal has a somewhat more inferior and anterior position. The predental beak is considerably longer than in *P. cristatus*, but its dorsal border does not, as in the latter, rise above the level of the teeth, and the contour of the chin is quite different, rising less steeply from the ventral border, with its anterior part continued forward more horizontally.

MEASUREMENTS.

Mandible, length from angle	.105	Mandible, distance angle to $_{\overline{4}}$	.053
" height of condyle	.039	" length of predental beak	.023
" " " coronoid	.049	" depth of ramus below $_{\overline{3}}$	.023
" distance condyle to $_{\overline{4}}$	.045	" breadth over angular processes	.051

The cervical vertebræ are very small; they resemble those of the smaller species of *Hapalops*, but are more delicate, with more slender transverse processes and neural arches, and short, weak neural spines. The thoracic vertebræ are quite characteristically different from those of *Hapalops;* in the anterior part of the thorax the vertebræ have very small centra, which increase posteriorly in size, but this increase is relatively less than in *Hapalops;* only on the centrum of the last thoracic are the ventral foramina visible. The most peculiar feature of these vertebræ is the form of the neural spines, which throughout the region vary little in size, shape and inclination; as compared with those of a small species of *Hapalops*, they are much shorter, more slender and more steeply inclined. The small, uniform size and almost unchanging degree of inclination of the spines give to this vertebral column an appearance which is conspicuously different from that of most of the other Santa Cruz Gravigrada. The transverse processes are very short; the zygapophyses do not differ from those of other members of the family, the accessory pairs appearing on the last two thoracics.

The only lumbar preserved, and in an incomplete state, is the first; in this the ventral foramina are much more conspicuous than on the last thoracic.

Of the two incomplete caudal vertebæ found with this specimen, one is from the anterior part of the tail, probably the fourth or fifth of the series, and the other is from the hinder portion; these vertebræ indicate a tail very similar in its proportions to that of *Hapalops*.

A single segment of the mesosternum is preserved; the body, or dorsal part, of the segment is relatively short, broad and thin, but the ventral projection which carries the facets for the tubercles of the sternal ribs is exceedingly prominent.

MEASUREMENTS.

? Fourth thoracic, length of centrum	.015	Last thoracic, length of centrum	.017
" " width of anterior face	.014	" " width of anterior face	.023
" " " " posterior face	.017	" " " " posterior face	.026
" " " over transverse processes	.035	" " " over transverse processes	.040
" " height of neural spine from centrum	.021	" " height of spine from centrum	.029
" " width of neural spine at base	.015	" " width of spine at base	.019
" " width of neural spine at tip	.010	" " " " " " tip	.0115

The scapula has lost the distal epiphysis with the coracoid, and the glenoid border is much broken, but the shape of the bone is evidently different from that of *Hapalops* in its shortness and breadth; the spine, which for the proximal third of its course is hardly noticeable, is so placed as to make the prescapular fossa much larger than the postscapular, and the glenoid border is, as usual, elevated into a prominent ridge.

The humerus (Plate LIII, fig. 3) also differs notably from that of *Hapalops;* the head is relatively large and projects well behind the plane of the shaft, and the internal tuberosity is unusually large; the deltoid area is less developed than in any other of the known Santa Cruz Gravigrada, and, though of the usual length, its borders are not at all prominent. The shaft is quite stout, diminishing in size distally, until it is greatly broadened by the supinator ridge; this ridge, the internal epicondyle and the foramen are much as in the other genera, but the external epicondyle is unusually prominent. The trochlea is quite peculiar and more nearly approximates that of *Megalonyx* than does the trochlea of *Hapalops;* compared with the latter, it is narrower and more than half of its breadth is taken up by the prominent, hemispherical facet for the radius; the ulnar facet is narrower, much more convex transversely, and its inner border is not produced into a flange; the anconeal fossa is very small and shallow.

As the ulna (Plate LIII, fig. 4) has lost both epiphyses, its length is not determinable; the olecranon was, however, obviously shorter than that of *Hapalops* and the shaft is more slender and more regularly curved, the posterior border being continuously convex.

Metacarpals IV and V, the only part of the manus preserved, are surprisingly small and indicate either that the whole manus was very small, or, more probably, that the ulnar side was greatly reduced. Metacarpal IV is of nearly the same length as the corresponding metatarsal, but much more slender, and considerably exceeds in length metacarpal IV of *Schismotherium fractum*, the proximal end has a very complex facet for the unciform and on the ulnar side is a deep pit which receives the head of V; in *Hapalops* this facet is much more nearly plane; the distal trochlea is narrow, but has a very prominent carina. The fifth metacarpal also is longer and much more slender than in *Schismotherium*, and the narrow proximal end is occupied by the saddle-shaped facet for the unciform; the shaft is very slender and the distal trochlea is imperfect, with almost obsolete carina.

MEASUREMENTS.

Humerus, length	.136	Metacarpal IV, distal width	.007
" thickness of proximal end	.032	" " " thickness	.012
" width of trochlea	.028	Metacarpal V, length	.021
" " " distal end over epicondyle	.060	" " proximal width	.0055
Metacarpal IV, length	.028	" " " thickness	.0075
" " proximal width	.009	" " distal width	.005
" " thickness	.011	" " " thickness	.007

The fragment of pelvis merely indicates the likeness of the ilium to that of *Hapalops*.

The femur (Plate LIII, fig. 5) lacks the proximal epiphysis, except a portion of the head, which is directed more proximally and less internally than in *Hapalops;* the second trochanter is very prominent, but the third is more reduced than in any other Santa Cruz genus of the order. The shaft is to some extent intermediate between the form seen in *Analcimorphus* and the more usual type seen in *Hapalops*, being shorter and broader than in the former, less flattened and with more convex surfaces than in the latter.

The tibia (Plate LIII, fig. 6) is considerably shorter than the femur; the spine is low, blunt and feebly grooved, and the cnemial process is rugose; the shaft has a very strong anterior curvature and, on the inner side above the middle, is a prominent tubercle; the great projection from the inner side of the distal end is more massive than in the other genera. The astragalar surface is remarkably flat, and though the intercondylar tongue appears on the dorsal border, it is not continued backward as a ridge, and the facet for the inner condyle of the astragalus is very much less concave than usual.

MEASUREMENTS.

Femur, proximal width	.044	Tibia, proximal thickness	.040
" distal width	.054	" least width of shaft	.017
Tibia, length	.114	" distal width	.0395
" proximal width	.051	" " thickness	.023

Of the pes (Plate LIII, fig. 7), this individual lacks all the tarsus, except the cuboid, and the first digit. The cuboid is quite peculiar and has a very different appearance from that of *Hapalops;* it is relatively long and narrow and has an oblique position in the tarsus; the calcaneal facet is large and convex and almost lateral in position, and the astragalar facet, which is smaller than in *Hapalops*, meets the former at an acute angle; on the tibial side distally and almost confined to the dorsal border, is a small oblique facet for metatarsal III; the distal end is occupied chiefly by the large, saddle-shaped surface for the fourth metatarsal, that for the fifth being very much smaller and placed at the postero-external angle.

The metatarsus most resembles that of *Analcimorphus* and, presumably, that of *Schismotherium* also, but with certain well defined characteristics of its own.

Metatarsal II is short and massive and, though somewhat narrower in proportion to its length, is otherwise so similar to that of *Hapalops* as to require no particular description.

Metatarsal III is somewhat shorter and heavier than II, but is not so extremely shortened as in the genus last named, and the facet for the ectocuneiform has no such deep median notch; the proximal end is very broad, extensively overlapping the head of IV and articulating by a considerable facet with the cuboid, an articulation which has not been observed in any other Santa Cruz genus of the order. The shaft is very short, broad and thick, somewhat contracted in the middle and broadening slightly at the distal end, and the distal trochlea has an immense carina. It is worthy of notice that the two sesamoids, which are attached to the plantar side of the distal trochlea, are of very different sizes, that on the tibial side being far larger and resembling a small pisiform in appearance. How far this arrangement is peculiar to *Pelecyodon*, cannot at present be determined.

Metatarsal IV is longer and very much more slender than III, but does not exceed the latter in length so much as in *Hapalops*, the relative lengths of the two bones being more as in *Analcimorphus*, though IV is far more slender than in the latter and has a narrower proximal end than in either of the genera mentioned.

Metatarsal V is far shorter and slighter than IV and indeed is much more reduced than in any of the other genera of which the foot-structure has been determined; the proximal end is broad and thick, but the process given off from the fibular side is much smaller than in *Hapalops* and the distal trochlea, though small, retains a prominent carina, which has been lost in the latter genus.

The phalanges are proportionately longer and lighter than those of *Hapalops*, and those of the various digits differ much in size; the ungual phalanx of digit III is of relatively enormous size, much exceeding any of the others, and making this the longest, as it is by far the heaviest digit, despite the shortness of the metatarsal and of the second phalanx. The phalanges of digit IV, which approximately equal those of digit II in length, are very slender, while those of V are greatly reduced. The unguals are more slender, decurved and sharply pointed than in *Hapalops* and the distal cleft is longer and more distinct.

MEASUREMENTS.

Metatarsal II, length	.026
" " proximal width	.014
" " distal width	.012
" " " thickness	.018
Metatarsal III, length	.023
" " proximal width	.024
" " distal width	.0155
" " " thickness	.0205
Metatarsal IV, length	.029
" " proximal width	.009
" " distal width	.009
" " " thickness	.012
Metatarsal V, length	.025
" " distal width	.006
" " thickness	.0095
First phalanx, digit II, length	.013
" " " " proximal width	.011
" " " " " thickness	.018
" " " " distal thickness	.013
First phalanx, digit III, length	.016
" " " " proximal width	.013
" " " " " thickness	.023
" " " " distal thickness	.017
First phalanx, digit IV, length	.012
" " " " proximal width	.010
" " " " " thickness	.017
First phalanx, digit V, length	.0095

MEASUREMENTS.

First phalanx, digit V, proximal width	.007
" " " " " thickness	.011
Second phalanx, digit II, length	.024
" " " " proximal width	.011
" " " " proximal thickness	.015
Second phalanx, digit III, length	.022
" " " " proximal width	.013
" " " " proximal thickness	.019
Second phalanx, digit IV, length	.022
" " " " proximal width	.008
" " " " proximal thickness	.0135
Second phalanx, digit V, length	.012
Second phalanx, digit V, proximal width	.006
" " " " proximal thickness	.0095
Ungual, digit II, length	.048
" " " proximal width	.010
" " " " thickness	.016
Ungual, digit III, length	.060
" " " proximal width	.016
" " " " thickness	.034
Ungual, digit IV, length	?.044
" " " proximal width	.010
" " " " thickness	.0145
Ungual, digit V, length	?.023
" " " proximal width	.006
" " " " thickness	.010
Digit II, length	.091
" III, "	.094
" IV, "	.085
" V, "	.056

PELECYODON MAXIMUS Ameghino.

Pelecyodon maximus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 324.

Adiastemus compressidens Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 161.

The type of this species is a single tooth, which seems not to be distinct from the mandible afterwards described as *Adiastemus compressidens*, and represents considerably the largest species of the genus. The first lower tooth differs somewhat in size and shape in the two halves of the jaw, that on the right side being somewhat larger and more trihedral, and that on the left more elliptical; $\frac{}{2}$ is very large, broad, antero-posteriorly compressed, and $\frac{}{3}$ is slightly wider; $\frac{}{4}$ is less cylindrical than in the other species and more transversely oval, though placed obliquely to the line of the other teeth.

The dimensions are from a photograph of the type of *A. compressidens* in the Ameghino collection.

MEASUREMENTS.

Lower dentition, length	.032
" " " $\overline{2}-\overline{4}$	.025
$\overline{1}$ length (*i. e.*, antero-posterior diameter) right side	.007
" width (*i. e.*, transverse diameter) right side	.004
$\overline{1}$, length, left side	.006
$\overline{1}$, width, left side	.003
$\overline{2}$, length	.006
" width	.010
$\overline{3}$, length	.006
" width	.0105
$\overline{4}$, length	.007
" width	.0095

PELECYODON BOMBIFRONS (Ameghino).

Uranokyrtus bombifrons Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 160.

The type and only known specimen of this species is the weathered facial region of a skull, with all the teeth broken to the level of the alveoli. Ameghino has referred it to a distinct genus because of the coössification of the nasals and frontals, probably an abnormality. As a species, however, it is quite well defined. In the dentition $\underline{3}$ is remarkably large and the two series of upper teeth are not so nearly parallel as in the other species of the genus, but converge posteriorly, making the palate more triangular and more convex behind.

The dimensions are taken from Ameghino's original description ('94^a, 161).

MEASUREMENTS.

Upper dentition, length	.038
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.007
" width (*i. e.*, transverse diameter)	.004
$\underline{2}$, length	.008
" width	.008
$\underline{3}$, length	.007
" width	.012
Palate, width at $\underline{1}$	.018
" " " $\underline{2}$	.013
" " " $\underline{5}$	.007

PLANOPSIDÆ.

This term is proposed instead of the name *Prepotheriidæ*, which Ameghino has employed ('94^a, 161), on account of the rule of nomenclature which requires that the family name shall be taken from the genus first described, and because of the grave doubt as to whether *Prepotherium* is not a synonym of *Planops*. There is some reason to believe that the animals referred to this family may prove to be nearly related to the *Megatheriidæ*, to which they have several suggestive resemblances, and in that case, it would be advisable to incorporate them in the latter family, though it would be premature and perhaps misleading, to do so without fuller information.

In Santa Cruz times the members of this family were far less abundant and varied than the *Megalonychidæ*, which they much exceed in average size; the largest known Gravigrada from the formation belong to the *Planopsidæ* and none of them are very small. The teeth are non-lobate and the small upper caniniforms, which in all known examples are isolated by diastemata, are inserted far behind the anterior border of the maxillary.

The skull is elongate and cylindrical, with no trace of a sagittal crest, but with the cranial roof more or less flattened and having some cancelli and incipient sinuses in the parietals. The premaxillæ are not known, but the facets for them upon the maxillaries show that they must have been quite different from those of the preceding family, and the rostrum is longer; the palate is much less convex and rugose.

In no genus of the present family is the number of trunk-vertebræ known, but there is good reason to believe that the back was very long and that the number of vertebræ was quite equal to that which is found in the contemporary *Megalonychidæ*. A difference from the latter family is to be observed in the lumbar region, where a second pair of accessory pre- and postzygapophyses is added. The tail is extremely heavy.

The bones of the fore-limb have a general resemblance to those of the preceding family, but are considerably longer in proportion; those of the manus show many differences of detail, the most important of which is the shape of the ungual phalanges, which are much broader, more decurved and blunter than in the *Megalonychidæ*.

The pelvis is chiefly remarkable for the great elongation of the pubes and ischia, which produces a decided resemblance to *Megatherium*. The femur is extremely broad and antero-posteriorly compressed and flattened, much more so than in the preceding family, while the tibia differs less from that of the latter. Little is known of the pes, but the calcaneum and astragalus have certain very significant characteristics. As compared with those of the *Megalonychidæ*, the following differences may be noted: (1) the astragalus has entirely different proportions, being much shorter and broader; (2) the inner condyle is much shorter proximo-distally, strongly convex and projecting prominently towards the inner side; this is obviously the first stage in the remarkable transformation of the astragalus which characterizes *Megatherium;* (3) the calcaneum has a much more prominent sustentaculum, the astragalar surface of which presents dorsally instead of distally, and the cuboid facet is very narrow dorso-ventrally.

Evidently the significance of these differences is that a beginning had been made in the rotation of the foot, so as to bring the weight upon the fibular border.

PLANOPS Ameghino.

(Plates LVIII; LIX, Figs. 1–1^b.)

Planops Amegh.; Enumeracion sistem., etc., 1887, p. 23.
Schismotherium Mercerat, in part; Rev. del Museo de La Plata, T. II, 1891, p. 8.

In the collection of the American Museum of Natural History is the greater part of a skull of *P. longirostratus* and in the Princeton collection is a nearly complete skull, lacking the mandible, of a new and much larger species; both skulls represent quite immature animals, as all the sutures are still open. These specimens give us much welcome information regarding a genus which has hitherto been so imperfectly known, but of the skeleton nothing has yet been found.

The dentition is characteristic and seems to be unusually constant; $\frac{1}{}$ is small, cylindrical and caniniform; it is implanted very far behind the anterior border of the palate and is followed by a considerable diastema. The remaining teeth are molariform and of transversely oval or subrectangular shape; $\frac{3}{}$ is the largest and $\frac{5}{}$ the smallest of the series, and the latter has on the posterior face a median vertical groove, which gives the grinding surface a reniform shape. All of the teeth are small in proportion to the size of the animal and the two series are nearly parallel.

The skull has neither sagittal crest nor temporal ridges; the rostrum is unusually long and has almost parallel sides and the preorbital fossæ are very shallow; the palate is but slightly convex between the molariform teeth and less roughened than in the preceding genera, and anteriorly is flat or even somewhat concave; the premaxillæ were evidently large, the facets for them upon the maxillaries being of uncommon size, while the median notch for the spines is a characteristically deep and narrow V.

That *Planops* is very closely allied to *Prepotherium* is clear; indeed, more extensive material may perhaps show that the two are identical. On the other hand, the likeness to *Analcimorphus* is unmistakable and the latter genus connects the present group with the *Megalonychidæ*. The probable relationships between the *Planopsidæ* and the *Megatheriidæ* can be most conveniently discussed in connection with *Prepotherium*.

PLANOPS MAGNUS sp. nov.

(Plate LVIII.)

This species may be recognized by its very large size, for it is one of the largest known Santa Cruz Gravigrada, by the length of the rostrum, and by the more rectangular, less oval, shape of the upper molariform teeth. The type is a well-preserved skull (No. 15,346), lacking the premaxillæ, jugals and mandible, which was found by Mr. Hatcher at Killik Aike.

The caniniform ($^{\underline{1}}$) is small, recurved, of longitudinally elliptical section, and with nearly horizontal masticating surface; a considerable space separates this tooth from $^{\underline{2}}$, but the distance in front of it, to the anterior edge of the palate, is more than twice as long as the diastema; $^{\underline{2}}$ is transverse and molariform, longer antero-posteriorly than any of the other teeth and narrower transversely than any except $^{\underline{5}}$, and is of an irregularly quadrate shape; $^{\underline{3}}$ is broad and antero-posteriorly compressed and more nearly rectangular than any of the others; $^{\underline{4}}$ is like $^{\underline{3}}$, but slightly smaller and less regular; $^{\underline{5}}$ is much smaller and with reniform grinding surface, owing to the posterior vertical sulcus.

MEASUREMENTS.

Upper dentition, length	.062	$^{\underline{2}}$, length	.009
" " " $^{\underline{2}-\underline{5}}$	.040	" width	.012
Distance from $^{\underline{1}}$ to anterior edge of maxillary	.036	$^{\underline{3}}$ length	.009
		" width	.014
Diastema between $^{\underline{1}}$ and $^{\underline{2}}$, length	.017	$^{\underline{4}}$, length	.008
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.008	" width	.013
		$^{\underline{5}}$ length	.007
$^{\underline{1}}$, width (*i. e.*, transverse diameter)	.0063	" width	.011

In most of the Santa Cruz Gravigrada the highest point in the upper contour of the skull is the parietal eminence, which is in nearly the same vertical line as the glenoid cavity. In the present species, however, the upper contour is nearly straight, the rise from the occiput is very slight and the highest point is not in the parietal, but in the frontal zone, a little behind the orbits; from the summit forward is a long and gradual descent. Except for the descending side walls of the posterior nares, the dorso-ventral diameter of the cranium is nearly uniform throughout, while that of the face diminishes anteriorly. Viewed from above and disregarding the zygomatic arches, this skull appears like an elongate, slightly irregular tube; it is wide in the parietal zone, contracting gently to the postorbital constriction, thence gradually expanding again to the forehead. No sagittal crest is present, merely a broad and obscurely marked sagittal area. The preorbital region, or rostrum, is unusually long and has nearly straight, parallel sides, though narrowing forward slightly; the preorbital fossæ are very shallow and hardly visible from above.

The occiput is relatively high and has a distinct forward inclination; the crest would appear not to have been prominent, though the loss of the supraoccipital leaves this somewhat uncertain; the foramen magnum is transversely elliptical. The basioccipital is long and broad, strongly convex behind, almost flat in front; from the foramen magnum a shallow median groove is continued for a short distance, a feature which has not been observed in any other species; the condylar foramen is small and the foramen lacerum posterius is large. The low and wide exoccipitals do not meet in the median line, leaving between them a narrow space where the supraoccipital reaches the foramen magnum; above the foramen the exoccipitals are produced almost as far as the hinder margin of the condyles, which are rather small; the paroccipital processes are obsolete. The supraoccipital is lacking, but its shape is sufficiently indicated by the surrounding sutures; it was very broad and shield-shaped, with a median ventral process, which, as already mentioned, extended between the exoccipitals to the foramen magnum; it must have formed much the greater portion of the occipital surface, and dorsally was reflected forward for a short distance between the divergent parietals. The exposed portion of the periotic is a narrow vertical ridge, with a groove on each side of it, and ends ventrally in a roughened process. The tympanics have been lost, but the size of the fossæ thus exposed apparently indicates that these bones were larger than in the other genera.

In marked contrast to the smaller Gravigrada of the period, the parietals are, at least along the hinder border, very thick and filled with cancelli and small sinuses; over most of their area these bones have a smooth, dense surface, and anteriorly they have short median processes between the frontals. So far as it is not covered by the pterygoids, the basisphenoid is broad and nearly plane, with a large tubercle at each postero-internal angle, just behind the pterygoid suture. The presphenoid is concealed by the vomer, the median plate of which descends more gradually and is not so conspicuous in the posterior nares as it is in *P. longi-*

rostratus. The alisphenoid, though large, is almost confined to the ventral aspect of the cranium, where it follows the course of the squamosal and has a short suture with the parietal and a longer one with the frontal; the descending process is large and its ventral border is thickened and cancellous. The outer portion of the relatively large orbitosphenoid is depressed by two concavities leading respectively to the optic foramen and foramen lacerum anterius.

The frontals are very large and have an inflated look, which indicates the presence of large sinuses; the postorbital foramina are uncommonly large and conspicuous; the sutures with the maxillaries are relatively long and straight, with a wide, shallow notch between them for the nasals. The squamosal is relatively small and forms no part of the occipital crest and has no connection with the exoccipital, from which it is separated by the periotic; the broad, deep notch of the ventral border for the auditory meatus produces quite a distinct posttympanic process and the whole infero-lateral angle of the bone is rugose; the glenoid cavity is but moderately concave, but extends farther upon the zygomatic process than in any of the other genera; this process is short and rather slender and has a distinct downward inclination. Although the jugal has been lost, its great length is demonstrated by the space between the zygomatic processes of the squamosal and maxillary. The lachrymal is of the ordinary type.

The nasals have quite a characteristic form; they are widest posteriorly, contracting forward to the narrowest part and thence broadening slightly to the anterior end; along the median line, where the two nasals meet, is a narrow and shallow, but well defined groove; at the forward end each nasal has a long lateral process, defined by a deep notch, while the median part is obliquely truncated, forming with its fellow a blunt point. The anterior nares are broad and low, with sides and top regularly curved and describing somewhat more than half of a transverse ellipse.

The maxillary is very long, especially the preorbital portion, which is for the most part convex, the preorbital fossa being shallow and inconspicuous and dying away dorsally. Owing to the narrowness of the nasals and the curvature of the maxillaries, the latter form more than half of the roof of the nasal chamber, and their anterior edge is thin, except at the infero-lateral angles where they are much thickened to form the facets for the premaxillæ. The large and heavy zygomatic process is perforated by a short infraorbital canal, the anterior opening of which is double. The hard palate is long and narrow, with posterior convexity less marked than in the preceding genera, and the whole palate is less rugose and has far fewer vascular perforations than in the latter; anteriorly, on each side of the median line and opposite the caniniform teeth, is a foramen continued forward by a well defined groove almost to the border of the palate. The palatines contribute but little to the hard palate, extending to a line opposite the middle of $\underline{4}$ and much narrowed by the broad alveolar processes of the maxillaries. The posterior nares do not extend so far forward as in most of the contemporary Gravigrada, the front margin being a little behind $\underline{5}$; the ventral border of the walls of the canal is thickened throughout. The short and narrow pterygoids are not entirely concealed by the alisphenoids, a narrow strip appearing externally behind the latter; they end ventrally in tubercles which form projections on the inner side and hinder border of the narial canal.

MEASUREMENTS.

Skull, length in median basal line	.189	Rostrum, width at preorbital fossæ	.046
" " condyle to anterior nares	.223	" " " anterior end	.041
Cranium, length condyle to edge of orbit	.153	Distance, occipital condyle to glenoid cavity	.035
Face, length orbit to anterior nares	.071	Distance, occipital condyle to $\underline{5}$	.093
Occiput, height	.064	Zygomatic arch, length	.119
" width at base	.074	Palate, length in median line	.078
Skull, width at postorbital constriction	.054	" width in front of $\underline{1}$	.037
" " over lachrymals	.084	" " at $\underline{2}$	.023
Forehead, width	.073	" " " $\underline{5}$	.021

PLANOPS LONGIROSTRATUS Ameghino.

(Plate LIX, Figs. 1–1^b.)

Planops longirostratus Amegh.; Enumeracion sistematica, etc., 1887, p. 23.

Schismotherium intermixtum Mercerat, in part; Rev. del Museo de La Plata, T. II, 1891, p. 8.

The skull in the Brown collection of the American Museum of Natural History agrees very well with the type of *P. longirostratus* in the La Plata Museum and also with the specimen which Ameghino has figured ('94^a, 164, fig. 63), but is much better preserved than either; the parietals, occiput, basis cranii and mandible are lacking, but otherwise the skull is in an excellent state of preservation.

Compared with *P. magnus*, the most obvious characteristic of the present species is its very much smaller size, though there are numerous less striking differences in the teeth and skull structure. The upper caniniform is not placed quite so far behind the anterior border of the maxillary, and the diastema between $\underline{1}$ and $\underline{2}$ is also somewhat shorter proportionately; $\underline{2}$ resembles the corresponding tooth of *P. magnus*, except in size; $\underline{3}$ and $\underline{4}$ are rather more elliptical and less rectangular in shape and the long axis of each of these teeth is more oblique to the median line of the palate, inclining slightly forward, as well as externally; $\underline{3}$ is somewhat the largest of the molariform series, though not much exceeding $\underline{4}$ in this respect; $\underline{5}$ is, as usual, reduced in size and, as in the preceding species, has a reniform grinding surface, with deep vertical groove on the posterior side.

MEASUREMENTS.

Upper dentition, length	.048
" " " $\underline{2}$–$\underline{5}$	.032
Distance, $\underline{1}$ to anterior border of maxillary	.019
Diastema between $\underline{1}$ and $\underline{2}$	.011
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.006
$\underline{1}$, width (*i. e.*, transverse diameter)	.0043
$\underline{2}$, length	.0065
" width	.0085
$\underline{3}$, length	.0065
" width	.0095
$\underline{4}$, length	.0055
" width	.0093
$\underline{5}$, length	.0055
" width	.007

In the skull the resemblance between the two species is very close, but, even disregarding size, there are a number of differences which appear to be characteristic and constant. In *P. longirostratus* the sagittal area upon the frontals is much narrower and the area and the temporal ridges are better defined. The top of the skull is more nearly horizontal and the descent to the rostrum is much more gradual; the lachrymal is broader, but less prominent, and the foramen is smaller. The rostrum is shorter and wider and narrows more anteriorly, while the preorbital fossæ are more distinct; the nasals are shorter and wider and do not emarginate the frontals so deeply.

MEASUREMENTS.

Face, length orbit to anterior nares	.045
Skull, width at postorbital constriction	.048
" " " forehead	.060
" " over lachrymals	.067
Rostrum, width at preorbital fossæ	.037
" " " anterior end	.030
Zygomatic arch, length	.086
Palate, length in median line	.053
" width in front of $\underline{1}$	.031
" " at $\underline{2}$	.019
" " " $\underline{5}$	.019

Ameghino has referred two additional species to this genus, but the material is too fragmentary for satisfactory determination. The references are as follows.

PLANOPS OBESUS Ameghino.

Eucholœops infernalis Amegh., in part; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent., 1889, Pl. XXXIX, fig. 8.

Planops obesus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 322.

PLANOPS CYLINDRICUS Ameghino.

Hapalops cilindricus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 318.

Planops cylindricus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 164.

PREPOTHERIUM Ameghino.

(Plates LIX, Figs. 2, 2^a; LX, LXI.)

Prepotherium Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 158.

Eucholœops Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 95.

It is a curious fact that, save for the teeth, little or no direct comparison can yet be made between this genus and *Planops*, because the parts that are known in the one are not yet known in the other. Much doubt therefore remains as to the propriety of separating the two and, even admitting the validity of the distinction, we cannot yet be quite certain that all the species referred to *Prepotherium* actually belong together.

So far as may be judged from the extant material, the teeth are very constant in their character for the genus as a whole and for each of its constituent species and there is no such puzzling variability as occurs in the other two families of Santa Cruz Gravigrada. The two series of upper teeth, which in *Planops* are parallel, have a distinct convergence backward; $^{\underline{1}}$ is small, subcylindrical, horizontally abraded and followed by a considerable diastema; the molariform teeth are well spaced apart, of elliptical form, very broad transversely and much compressed anteroposteriorly; $^{\underline{3}}$ is the largest of the series, while $^{\underline{4}}$ and $^{\underline{5}}$ diminish regularly in size. In the lower jaw, $_{\overline{1}}$ is like the corresponding upper tooth, $_{\overline{2}}$ and $_{\overline{3}}$ are transversely elliptical, while $_{\overline{4}}$ tends to a subcylindrical form.

Although the difference is not at all radical, no other contemporary genus has such teeth and they may be recognized at a glance.

Hardly anything is known of the skull, merely the palate and most of the mandible; the former resembles that of *Planops* in being nearly flat, but differs in a decided tendency to assume the triangular form. The mandible has a long and broad predental beak and the ventral border of the horizontal ramus, which in *P. filholi* is but moderately convex, in *P. moyani* is so much arched downward as to have a notable resemblance to the jaw of *Megatherium*. The skeleton is very imperfectly known and only in association with one species, *P. potens*, and will be described under the heading of that species. In brief, it may be said that the known parts of the skeleton generally agree quite well with the corresponding parts of the Santa Cruz *Megalonychidæ*, but there are several significant differences, which are suggestive of a relationship with the *Megatheriidæ*. It can hardly be maintained, however, that any of the latter family were directly derived from any known species of *Prepotherium*.

Prepotherium filholi Ameghino.

(Plate LIX, Figs. 2, 2^a.)

Prepotherium filholi Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 158.

In addition to the type specimen in the Ameghino collection we have in the Brown collection of the American Museum of Natural History a right ramus mandibuli (No. 9,573), which appears to be referable to the present species.

The upper caniniform, $^{\underline{1}}$, is small, erect, cylindrical and horizontally worn, and the molariform teeth are characterized by their transverse width and great antero-posterior compression; the transverse crests are parallel, but the angles of the teeth are so rounded as to give the grinding surface a compressed oval, rather than a rectangular shape; $^{\underline{2}}$ and $^{\underline{3}}$ are of nearly equal size, $^{\underline{4}}$ and $^{\underline{5}}$ progressively smaller. The lower dentition differs slightly from the upper; $_{\overline{1}}$, which is implanted behind the end of the symphysis and is followed by a short diastema, is small and very slightly compressed laterally; $_{\overline{2}}$ and $_{\overline{3}}$ are transversely oval, but less compressed antero-posteriorly than the upper teeth; $_{\overline{4}}$ is also transverse, but with a tendency to the subcylindrical shape.

The hard palate is nearly plane between the molariform teeth and has a low ridge along the median line of suture; the backward convergence of the two dental series gives to the palate a characteristically triangular form.

The mandible (Plate LIX, figs. 2, 2^a) evidently had a very elongate predental beak, though the anterior portion is so broken that the exact length is not determinable; this elongation indicates a corresponding length of the rostrum and premaxillaries. From the portion preserved, it appears that this beak had nearly parallel sides, with flared and everted dorsal border, and probably the anterior end was much less pointed than in the Santa Cruz *Megalonychidæ* and may well have been as abruptly truncate as in *Megatherium*; the symphysis is long and much less steeply inclined than in *Hapalops* and the chin is much more gradually rounded. The dentary portion of the horizontal ramus is short, of no unusually great depth and with only a moderately convex ventral border; in this respect there is a very striking difference from *P. moyani*, a difference which may be partly, though not entirely, due to the immature age of the specimen before us. Posteriorly also, the ramus is incomplete, but it is apparent that the coronoid process is relatively short and quite erect and that the angle is decidedly inflected; the postero-external opening of the dental canal is at the base of the ascending ramus and is very narrow, hardly more than an oval slit.

In the subjoined table the dimensions of the upper teeth and palate are from the type, those of the lower teeth and the mandible from No. 9,573, a younger and smaller animal.

MEASUREMENTS.

Upper dentition, length $^{\underline{2}-\underline{5}}$	.046	Lower dentition, length $_{\overline{2}-\overline{4}}$	.029
$^{\underline{2}}$, length (*i. e.*, antero-posterior diameter)	.0085	$_{\overline{1}}$, length	.008
" width (*i. e.*, transverse diameter)	.016	" width	.006
$^{\underline{3}}$, length	.0085	$_{\overline{2}}$, length	.008
" width	.0165	" width	.0125
$^{\underline{4}}$, length	.0085	$_{\overline{3}}$, length	.0075
" width	.013	" width	.011
$^{\underline{5}}$, length	.006	$_{\overline{4}}$, length	.0085
" width	.0105	" width	.011
Palate, width at $^{\underline{2}}$	.020	Mandible, depth at $_{\overline{3}}$	.035
" " " $^{\underline{5}}$	.013	" thickness at $_{\overline{3}}$	.0185
Lower dentition, length	.043	" estimated length of beak	.050

PREPOTHERIUM MOYANI Ameghino.

(Plate LX, Figs. 1, 1ª.)

Prepotherium moyani Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 162.

This species, which is as yet known only from the type, is of nearly the same size as the preceding one, but differs in the form of the teeth and the character of the mandible. The molariform teeth have a more oval grinding surface than in *P. filholi*, with the transverse crests more curved and less parallel, while the antero-posterior compression is much less extreme; another distinction is that $\underline{3}$ is larger than $\underline{2}$, while in the preceding species $\underline{2}$ and $\underline{3}$ are of almost equal size; $\underline{5}$ has a deep vertical groove on the posterior side, producing a reniform grinding surface, as in both of the species of *Planops*.

Unfortunately, the mandible is far from complete, but the portion preserved is highly characteristic; the peculiarity consists in the very great vertical depth of the horizontal ramus in the dentary region, with extremely convex ventral border, which rises steeply behind and becomes concave below the ascending ramus; anteriorly, the rise is very gradual, much more so than in *P. filholi*, and indicates a very long predental beak. The animal appears to have been fully adult and yet the jaw has on its outer side a large number of minute vascular foramina, producing a surface texture unlike that of any other contemporary species. The external dental foramen has a slightly lower position than in *P. filholi* and is considerably larger, especially in width.

The resemblance of this mandible to that of *Megatherium* is very striking and suggests that the ancestor of the latter was allied to the present species.

MEASUREMENTS.

Upper dentition, length	.060
" " " $\underline{2}$–$\underline{5}$	.042
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.009
" width (*i. e.*, transverse diameter)	.007
$\underline{2}$, length	.0085
" width	.0115
$\underline{3}$, length	.0095
" width	.014
Lower dentition, length	.050
" " " $\overline{2}$–$\overline{4}$	.036
$\overline{1}$, length	.007
" width	.006
$\overline{2}$, length	.0095
" width	.0135
$\overline{3}$, length	.009
" width	.0145
$\overline{4}$, length	.0105
" width	.014
Mandible, depth below $\overline{3}$	.046
" " " $\overline{4}$	.040

PREPOTHERIUM POTENS Ameghino.

(Plates LX, Figs. 4–8; LXI.)

Prepotherium potens Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 325.

Eucholæops titan Lydekker; Anales del Museo de La Plata, T. III, 1894, p. 98.

This is much the largest known edentate of the Santa Cruz epoch and is the commonest representative of the genus, though all of the specimens yet obtained are lamentably imperfect and almost nothing is known of the skull. In the Princeton collection are a number of individuals which enable me to describe a considerable part of the skeleton, especially when supplemented by the material in the Ameghino collection.

Ameghino has described the teeth as follows: "The last upper molar has a deep vertical groove on the posterior face; diameter of $m^{\underline{2}}$, antero-posterior 9 mm., transverse 16.5 mm.; of $^{\underline{5}}$ 6.5 × 12 mm." ('91, 325). "The upper caniniform has a diameter of 9 mm.; the diastema is 11 mm. long; the interdentary region of the palate between the caniniforms is 25 mm. wide. The lower caniniform has a diameter of 7 mm. and the diastema which follows it is 8 mm. long; the first upper molar has an antero-posterior diameter of 10 and a transverse diameter of 15 mm.; the last lower molar has an antero-posterior diameter of 12 and a transverse diameter of 15 mm.; length of lower dentition 70 mm.; height of mandible below penultimate molar 55 mm." ('94^a, 163–4). The Princeton collection contains only two loose teeth associated with No. 15,521; one of these, which may be the third upper tooth, measures 11.5 × 18 mm., and the other, which appears to be the second lower tooth, measures 9.5 × 13.5 mm. As appears from the measurements, the teeth are very much compressed antero-posteriorly.

The parts of the skeleton represented by the various individuals are ten thoracic, four lumbar and three caudal vertebæ, and most of the sacrum; two segments of the mesosternum and several ribs; incomplete humerus, ulna and radius, and much of the manus; the greater part of the pelvis, femur and tibia complete, and fibula nearly so, while the astragalus and calcaneum are in the Ameghino collection.

Although the vertebral formula is not known, it is evident that the number of vertebræ was large, as is indicated by the great differences of size and form in the various parts of the thorax. The individual vertebræ resemble those of *Hapalops*, though on a much larger scale and with several characteristic modifications. Compared with the vertebræ in the hinder part of the thorax, the first thoracic is very small and shows that the neck was probably more slender than in *Hapalops;* the centrum is short, broad, much depressed, with feebly convex, D-shaped anterior face, and with two parallel, widely separated, thick and very prominent ventral keels, which do not occur in any of the preceding genera; the anterior facets for the rib-heads are large, slightly concave, and placed partly on the centrum and partly on the neural arch, while the small posterior facets project quite prominently from the postero-lateral angles of the centrum. The transverse process is very prominent and heavy and has a large facet for the tubercle of the first rib; the prezygapophyses are lateral in position, concave, very heavy and prominent, while the postzygapophyses are small, convex and placed on the neural arch.

The next vertebra of the series is one which corresponds in form to the tenth or eleventh thoracic of *Hapalops* (Plate LX, fig. 4); the centrum is relatively small and of quite a different shape from the first, having subtriangular faces and nearly equal transverse and dorso-ventral diameters; the neural canal is remarkably large, its diameters exceeding those of the centrum; the pedicles of the neural arch are high and narrow, the arch and spine extending far behind them; the spine is relatively short and slender and has a very strong backward inclination; the transverse process is shorter than on the first vertebra, but very prominent and heavy.

Behind the middle of the thorax the centra increase steadily in size, but the gradual way in which this increase is effected is strong evidence that the backbone was nearly or quite as elongate as in *Hapalops*. In the posterior part of the region the vertebræ are exceedingly large and have assumed the appearance of lumbars; the centra are massive, short, broad and thick, with subquadrate faces; the ventral foramina are nearly obsolete; on the last two vertebræ, at least, there are no facets for the tubercles of the ribs; the neural spines are shorter than in the middle of the thorax, and less inclined, but they are very heavy and much thickened at the free end; the transverse processes are very short, broad, sharply upcurved, and heavy and rugose at the distal end. The mode of articulation of these vertebræ is almost the same as in *Hapalops*, but the large size of the processes gives them a very complex appearance. Very large and concave prezygapophyses rise prominently above the neural arch, while the rugose metapophyses are shorter and heavier than in *Hapalops;* the accessory prezygapophyses are prominent, shelf-like projections below and external to the primary pair; the articular surface is not plane, as it is in *Hapalops*, but concave, and is reflected upward upon the external side of the primary pair, an incipient stage in the development of the *second* accessory pair of articulations. The postzgapophyses are convex semicylinders, separated from the transverse processes by deep, narrow notches; the accessory surfaces are on the transverse processes and chiefly on the ventral side, but partly reflected upon the dorsal side also.

Four lumbars are associated with one individual, but only the third is sufficiently well preserved to show the mode of articulation (Plate LX, figs. 5–5^b). In all of the lumbars the centra are of about the same length, but become broader and more depressed posteriorly, especially the hinder faces; the third and fourth have short and blunt, but quite prominent projections from the infero-lateral angles of the posterior faces; except in the first, in which they are obsolete, the ventral foramina are very large, and the opening in the floor of the neural canal is extraordinarily large in the second vertebra. The neural spines differ from those of the hinder part of the thorax in being longer vertically, narrower antero-posteriorly, but much thicker and more erect; the successive spines appear to have been nearly or quite in contact. The zygapophyses, at least of the third lumbar, have an additional complication, as compared with those of the posterior thoracic region, namely, that the accessory articular processes are each divided into two, one dorsal and one ventral, the only instance of the kind known among the Santa Cruz Gravigrada. What remains of the transverse processes shows that they were long, broad and depressed.

The number of sacral vertebræ can hardly have been less than five and may have been six. The first vertebra has a very broad and depressed centrum, thinning backward into a mere plate; all the other centra are of similar plate-like form, except the last, which has a large posterior face; the penultimate sacral has a pair of low, parallel, infero-lateral keels, which on the last become quite prominent and are separated by grooves from the chevron facets; very small ventral foramina appear on the first and last vertebræ. Posteriorly, at least, the neural canal is relatively larger than in

Hapalops and of a different shape, owing to its greater height; the ridge formed by the coalesced spines is high and has a much thickened free border. Only on the last two vertebræ are the transverse processes preserved; here, they are long and very heavy and are completely fused with the ischia, beyond which the distal ends project as short and massive protuberances.

Although of a similar type to those of the contemporary *Megalonychidæ*, the caudal vertebræ have a decided resemblance to those of *Megatherium*, especially in their massiveness. The first caudal (Plate LX, fig. 6) has a short, very heavy, block-like centrum, with two pairs of chevron-facets, of which the anterior pair is the smaller, though far better developed than in any of the preceding genera; in the latter a vascular groove on each side leads around the side of the centrum and behind the transverse process into the neural canal; in the present species the ventral portion of this groove is converted into a canal, forming a conspicuous foramen at the base of the transverse process, and another external to the posterior chevron-facet. The neural canal is very large, far higher than in *Hapalops*, and the pedicles of the arch are much more massive, as is also the short spine; the zygapophyses are remarkably heavy and there are no distinct metapophyses. The transverse processes are relatively somewhat shorter than in *Hapalops* and extend more obliquely backward, but are very much heavier and more expanded at the distal end.

Other caudal vertebræ preserved are the second, the ? sixth and part of the ? tenth; in all the centrum remains of nearly the same length, but with diminishing diameters, and the anterior pair of chevron-facets are much smaller than the posterior pair and quite widely separated from them; the processes diminish in the usual gradual manner, but their remarkable heaviness is characteristic of them throughout. In the ? sixth the transverse processes are much shorter and thinner than in the first or second, but are broader, especially at the distal end. Apparently, the tail in the present species was decidedly heavier than in the Santa Cruz *Megalonychidæ*, but relatively somewhat longer and more slender than in *Megatherium*.

The ribs are broader than in any of the preceding genera, approximating the proportions of *Megatherium* and *Mylodon*. The first rib is very short, but with a decided lateral curvature, making the inner border strongly concave; the broad side is turned forward and the outer border is quite thick; the neck is long and slender, projecting inward almost at right angles with the principal axis of the rib; the head bears a single circular and nearly plane facet which presents backward and articulates with the first thoracic; apparently there was no articulation with the seventh cervical; the tubercle rises prominently above the neck, bearing a large saddle-shaped facet. Distally, the rib is expanded and rugose and has a large facet for the manubrium; though no suture is apparent, this portion is doubtless the coössified sternal rib. What is believed to be the second rib has an even longer and more slender neck than the first; the facets on the head for the first and second thoracics are nowhere in contact, but separated by a narrow sulcus; the tubercle is smaller and lower than on the first; the shaft is the slenderest of all the ribs preserved, but, as in the first, the principal diameter is transverse. However, this rib forms the transition from the first to the succeeding ones, in which the antero-posterior diameter greatly exceeds the transverse and which are very broad and plate-like. In those ribs which articulate with two vertebræ the two facets of the head are entirely separate; passing backward, we find that the anterior facet is steadily reduced, until it disappears altogether, while the posterior is increased, finally covering the head. Throughout the series the neck is long, though broader and more depressed than in the first and second, and curving uninterruptedly into the shaft, not forming an angle with it. In the "true ribs" the distal end is somewhat expanded in both dimensions and bears a large, convex facet for the sternal rib, while in the "false ribs" the distal end is a very rough surface.

A single distal end of a sternal rib is preserved, which fits accurately the second and third segments of the mesosternum and bears a curiously close resemblance to the proximal end of a vertebral rib. The fragment is, in general, very similar to the corresponding bone of *Mylodon*, yet differs in a number of particulars; it is more compressed antero-posteriorly, thicker dorso-ventrally; the facets on the "head" for the ventral part of the sternal segments are separate, while the much smaller facets for the body of the sternal segments are confluent.

Of the sternum have been found two mesosternal segments (Plate LX, figs, 7, 7^a) which are of exactly the same type as in *Hapalops* and agree quite well with the second and third segments of *Mylodon*. It would be superfluous to give a description of these bones, which differ from those of *Hapalops* merely in size.

MEASUREMENTS.

First thoracic, length of centrum	.029
“ “ width of anterior face	.032
“ “ height “ “ “	.0185
“ “ width over transverse processes	.090
? Eleventh thoracic, length of centrum	.031
“ “ width of anterior face	.0285
“ “ height of anterior face	.026
“ “ width of posterior face	.035
“ “ height	.095
“ “ length of spine	.045
Penult. thoracic, length of centrum	.039
“ “ width of posterior face	.041
“ “ height of “ “	.038
“ “ width over transverse processes	.083
Last thoracic, length of centrum	.040
“ “ width of posterior face	.043
“ “ height of posterior face	.039
“ “ width over transverse processes	.084
“ “ height	.121
“ “ length of spine	.049
“ “ width of spine at end	.042
First lumbar, length of centrum	.043
“ “ width of posterior face	.049
“ “ height of posterior face	.036
Second lumbar, length of centrum	.043
“ “ width of posterior face	.042
“ “ height of posterior face	.039
“ “ height	.127
Third lumbar, length of centrum	.044
“ “ width of posterior face	.053
“ “ height of “ “	.034
“ “ height	.127
“ “ length of spine	.058
“ “ width “ “ at end	.038
Fourth lumbar, length of centrum	.044
“ “ width of posterior face	.053
“ “ height of “ “	.031

Fourth lumbar, height	.127
“ “ length of spine	.065
“ “ width of spine at end	.035
First caudal, length of centrum	.034
“ “ width of anterior face	.043
“ “ height	.086
“ “ width over transverse processes	.130
Second caudal, length of centrum	.034
“ “ width of anterior face	.040
“ “ height	.080
“ “ width over transverse processes	.116
? Sixth caudal, length of centrum	.032
“ “ width of anterior face	.036
“ “ height	.057
“ “ width over transverse processes	.086
? Eleventh caudal, length of centrum	.034
First sacral, width of anterior face	.057
“ “ height “ “ “	.031
Last “ width “ posterior face	.045
“ “ height “ “ “	.029
? Second mesost. segment, length	.032
“ “ “ width of anterior face	.025
“ “ “ width of posterior face	.029
“ “ “ length of process	.021
“ “ “ width of process	.024
“ “ “ height	.027
? Third mesost. segment, length	.029
“ “ “ width of anterior face	.0305
“ “ “ width of posterior face	.0305
“ “ “ length of process	.016
“ “ “ width of process	.026
“ “ “ height	.029

Although none of the fore-limb bones is complete, they are all so nearly so that a close approximation of their length may be obtained. With many resemblances to those of the contemporary *Megalonychidæ*, these bones have also a suggestive likeness to those of *Megatherium*, especially in their length and slenderness as compared with those of the hind-limb. The following table will show the very marked contrast between the present species and *Hapalops longiceps* in this respect, and the likeness of the former to *Megatherium*. In each species the length of the femur is taken as 100 and the other bones are calculated in percentages of that length.

MEASUREMENTS.

	Hapalops longiceps.	*P. potens.*	*Megatherium.*
Femur	100	100	100
Humerus	90.3	103.6	105.3
Radius	80.1	101.6	94.6
Ulna	92.9	115.4	106.6
Tibia	9.17	81.1	84

The humerus displays a general likeness to that of *Hapalops*, with a number of minor differences; the tuberosities are much larger than in *Megatherium* and as prominent as in *Hapalops*, though of more equal size, the external one being larger and the internal one smaller. The shaft is proximally broad and antero-posteriorly compressed, narrowing downward to a point just above the distal expansion; the deltoid area is less prominent than in the large species of the latter, but far longer, extending down the shaft below the level of the epicondylar foramen, where it abruptly terminates; the epicondylar foramen is covered by an unusually narrow bridge and from the course of this bridge it may be inferred that the epicondyle was less developed than in *Hapalops*. No part of the supinator ridge remains, but enough of the shaft is preserved to show that the ridge had no such proximal extension as in the last named genus. The humerus of *Megatherium* is very characteristic in appearance, which is chiefly due to the great reduction of the tuberosities and deltoid area, the slender, cylindrical proximal part of the shaft, the immense breadth distally, and the loss of the epicondylar foramen.

The radius resembles that of *Megatherium* in shape and in its remarkable elongation, being, in fact, longer in relation to both the humerus and the femur; the head is discoidal, not transversely oval, as it is in the

Santa Cruz *Megalonychidæ*, and simply concave; the proximal facet for the ulna is very small, not covering one third of the circumference of the head, but quite extended proximo-distally. The proximal portion of the shaft is compressed antero-posteriorly, much more than in *Hapalops*, and the abrupt broadening, which in the latter occurs nearly in the middle of the shaft, is very much nearer to the proximal end; the bicipital tubercle is very prominent and rugose. As a whole, the shaft is curved both laterally and anteriorly and quite closely resembles that of *Megatherium*, while the suprastyloid tubercle is much less prominent than in the latter; the carpal surface is narrower internally and less extended upon the styloid process.

The ulna is very like that of *Hapalops*. In *Megatherium* the olecranon is remarkably short and broad and inclined backward from the plane of the shaft, making the whole proximal end extremely massive, while the distal end of the ulna is narrow, very thick and incurved. In *Prepotherium*, on the other hand, the ulna differs from that of *Hapalops* merely in its straightness and relative length.

The manus (Plate LXI, fig. 3) is incompletely known, but the parts preserved differ in many ways from the corresponding elements of the Santa Cruz *Megalonychidæ*, without displaying any very marked approximation to those of *Megatherium*. Of the carpus, only the trapezoid and magnum have been identified; the former is longer proximo-distally than in *Hapalops;* the dorsal face is broad, but toward the palmar side the bone contracts almost to an edge; the scaphoid facet is not regularly saddle-shaped, but divided into two parts, the junction of which forms a low ridge; the distal facet for metacarpal II is similarly divided and on the radial side extends almost to the scaphoid surface. Evidently, the trapezoid had a more oblique position in the carpus than that of *Hapalops*. The magnum is very different from that of the latter genus, the proximal end rising toward the palmar side into a prominent head, almost as in an ungulate, and the proximo-internal border is not produced upward between the scaphoid and lunar, the lunar facet covers nearly the whole proximal end, making the contact with the scaphoid more lateral than proximal. On the distal end, the dorsal portion of the facet for metacarpal III is in two parts which meet nearly at a right angle; the palmar half is single, large and concave; dorsally, the magnum has no contact with metacarpal II, but the palmar extension overlaps the head of the latter.

It may be asserted with confidence that the manus was pentadactyl and that all the digits carried claws. Metacarpal I is short and very heavy and has a rugged, massive appearance, quite unlike the smooth, subcylindrical form seen in *Hapalops;* the facet for the trapezium is very large and oblique, forming a sharp edge with the facet for metacarpal II; the shaft is short, heavy and rugose; the distal trochlea is well developed and has a distinct carina.

Metacarpal II is very much longer, but relatively slender; the proximal end has a curiously warped surface for the trapezoid; dorsally there is no contact with the magnum, but on the palmar side there is an articulation of considerable extent; on the radial side of the head is a very large and slightly concave facet for the first metacarpal, and on the ulnar side a still larger facet for the third. The shaft is of very irregularly trihedral shape, increasing in diameter distally; it receives a somewhat twisted appearance from the presence of a prominent, oblique rugosity upon the dorsal face and from the obliquity of the carina; on the ulnar side, below the facet for III is a prominent rugosity, which may represent an incipient stage of the extensive connection between the second and third metacarpals, which characterizes *Megatherium*. The distal trochlea resembles that of *Hapalops*, except for the obliquity of the carina and the narrowness of the lateral facets.

Of metacarpal III only the distal end is preserved; the broken end of the shaft has an almost square section, of a diameter much exceeding that of metacarpal II. The carina is less extended palmo-dorsally and projects less in front of and behind the shaft than in *Hapalops*, and its free border is much less curved.

Metacarpal IV much exceeds II in length, though not nearly so much as in *Megatherium;* the proximal end must have been extensively overlapped by III, the facet for which is much more oblique than in *Hapalops*, leaving but a narrow surface for the unciform, while the facet for V resembles that in the latter genus, and there was evidently no such articulation between metacarpals III, IV and V, as in *Megatherium*. The shaft is much compressed laterally, but thick palmo-dorsally, the dorsal face being a narrow ridge. The trochlea is quite different from that of *Hapalops*, the carina being less prominent and having a straighter edge, while on the palmar side are small, but well defined and prominent facets, probably for the sesamoids.

Aside from the unguals, the phalanges do not differ markedly from those of *Hapalops* and have little resemblance to the highly specialized phalanges of *Megatherium*. The first phalanx of digit I is elongate and slender; the proximal trochlea is moderately grooved and deeply notched on the palmar border for the metacarpal carina, and the distal trochlea is also grooved and somewhat asymmetrical. In the second digit this phalanx is much like that of *Hapalops* in shape, but is relatively a little longer and its proximal end is somewhat less deeply grooved. The second phalanx of digit II differs but slightly from that of *Hapalops*, except in being a little shorter; the proximal trochlea is less deeply concave and its median dorsal portion does not form so prominent a beak; the distal trochlea has a shallower median groove and is invaded in the median dorsal line by a broad, shallow sulcus, which is not present in *Hapalops*, but there is no such fossa on the dorsum of the shaft, for the beak of the ungual, as appears in that genus. In digit III the second phalanx is shorter but much stouter than in digit II; it differs considerably in form from that of *Hapalops*, the median ridge and dorsal beak of the proximal trochlea are much less pronounced, and the phalanx is not constricted palmo-dorsally below the proximal trochlea; the distal trochlea has a shallower median groove.

The unguals are very different from any known Santa Cruz genus of the *Megalonychidæ* and have considerable likeness to those of *Mylodon*. Compared with that of *Hapalops*, the ungual of digit II is very long, broad and low; its dorso-palmar diameter is much less and consequently the dorsal surface is much less strongly arched, while the ventral surface is more so; the proximal trochlea is broader and less concave and has a far less prominent intercondylar ridge; the subungual process is extremely large and heavy; the distal end is bluntly rounded and the cleft becomes a very shallow dorsal groove. In the pollex the ungual is similar, but very much shorter and less depressed.

In the following table the lengths of the fore-limb bones are only approximate, but the error must be slight.

MEASUREMENTS.

Humerus, length	.309	Radius, proximal width	.035
“ proximal width	.090	“ “ thickness	.033
“ “ thickness	.063	“ distal width	.052
Radius, length	.303	“ “ thickness	.038

Measurements.

Ulna, length	.344
“ “ of olecranon	.062
“ width at sigmoid notch	.056
“ distal width	.020
“ “ thickness	.019
Metacarpal I, length	.038
“ “ proximal width	.022
“ “ distal width	.017
Metacarpal II, length	.064
“ “ proximal width	.023
“ “ distal width	.027
Metacarpal III, distal width	.026
Metacarpal IV, length	.089
Metacarpal IV, proximal width	.028
“ “ distal width	.025
Phalanx 1, digit I, length	.030
“ “ “ “ proximal width	.018
Phalanx 1, digit II, length	.028
“ “ “ “ proximal width	.025
Phalanx 2, digit II, length	.047
“ “ “ “ proximal width	.021
Phalanx 2, digit III, length	.043
“ “ “ “ proximal width	.026
Ungual, digit I, length	.045
Ungual, digit III, length	.085
“ “ “ proximal width	.023

The pelvis is represented by imperfect specimens, which give no information upon certain important questions, yet are sufficiently complete to show a number of significant differences from the pelvis of *Hapalops*. The ilium has an even shorter peduncle than in the latter; its anterior end is somewhat more expanded and everted and has a more definite and thickened crista. The dorsal portion of the ischium is less horizontal and extends upward as a broad, thin plate, which is ankylosed with the transverse processes of the last two sacral vertebræ; the tuberosity is not very large, yet more prominent than in *Hapalops*; the descending portion is very long, quite broad and very thin, making the obturator foramen large, with dorso-ventral diameter much exceeding the antero-posterior, and giving the posterior pelvic opening a remarkably large dorso-ventral diameter. The pubis is long and very slender, except distally, where it expands to take part in the symphysis, which is quite elongate. The resemblance of this pelvis to that of *Megatherium* is quite distinct.

The femur (text-figure 25^c, p. 173; Plate LX, fig. 8) is remarkable for its great breadth and antero-posterior compression; its general appearance and proportions are quite like those of *Megalonyx*, but there are certain suggestive similarities to *Megatherium*. The hemispherical head is very large, and the large pit for the round ligament, which is on the posterior side, is entirely enclosed in the articular surface; the neck is longer than in *Megatherium* and the bridge from head to great trochanter is longer and has a more concave border. The great trochanter is very large and massive and encloses a considerable digital fossa; the second trochanter differs from that of the Pleistocene genera in being a prominent, bluntly conical tubercle and not a roughened ridge; the third trochanter is much less prominent than in the Santa Cruz *Megalonychidæ* and of quite a different shape; it does not, as in *Hapalops*, rise abruptly from the shaft, but forms a long, gentle convexity, the middle part of which is thickened and rugose and represents the trochanter proper, much as in *Megalonyx*, though larger. The shaft is very broad and antero-posteriorly compressed; the anterior face is convex transversely, slightly concave longitudinally, and its proximal half has parallel ridges for muscular attachment, as in the Pleistocene genera; on the hinder face a low, but distinct, ridge runs obliquely from the great trochanter to the inner side of the shaft, somewhat below the middle. The external tuberosity is very prominent, more so than in *Megalonyx*, but less than in *Megatherium*, while the internal is even larger than in the latter.

The distal articular surfaces have a significant likeness to those of *Megatherium*, though they are much less specialized; the condyles are of more nearly equal size and not so widely separated; the external condyle is less reduced, especially in width; the rotular trochlea is broader and less concave transversely, and is connected with both condyles, but in a very significant way. In *Megalonyx* the external condyle is separated from the trochlea and the inner condyle is connected with it "only by a narrow, isthmus-like prolongation" (Leidy, '55, 38) but the articular surfaces are not continuous, which led Owen to suggest that in this genus the knee-joint had three synovial capsules ('60, 813). In *Hapalops* the articular surfaces of both condyles are continuous with the trochlea, but the *Megalonyx* type is present in an incipient degree, the connection being much narrowed by an extension of the intercondylar notch on both sides. In *Megatherium* the external condyle is broadly continuous with the trochlea, but the internal condyle is widely separated from the latter. As regards the distal end of the femur, *Prepotherinm* stands in the same relation to *Megatherium* as *Hapalops* does to *Megalonyx;* both condyles are connected with the trochlea, but, while the external one is broadly so connected, the internal is united with the trochlea by a very narrow bridge.

The tibia (Plate LXI, figs. 2, 2^a) is not very different from that of *Hapalops*, but its differences are in the direction of *Megatherium*. The proximal end is broad, very heavy and somewhat compressed antero-posteriorly; the condyles are more equal than in *Hapalops* and the spine is less prominent; the cnemial process is a massive transverse ridge, which is not extended down the shaft and projects very little. The shaft is broad, antero-posteriorly compressed, and contracts from the proximal end, expanding again at the distal end. The astragalar surface is quite different from that of *Hapalops*, being much more distinctly divided into two facets by an intercondylar ridge and by a short, deep sulcus from the dorsal border; the inner facet is much more concave, the outer one very shallow; the internal malleolus is much less reduced, the deeply grooved process which arises from the inner side, behind the malleolus, is decidedly less prominent.

The fibula, which has lost the proximal end, has a stout, trihedral shaft, somewhat compressed laterally, and with a rugged linea aspera along the postero-internal border. The distal end forms a very massive external malleolus, which is not unlike that of *Megatherium*, but extends much farther below the level of the tibia.

Little is known of the pes. The astragalus (Plate LX, fig. 2) differs in a marked way from that of all the contemporary *Megalonychidæ*, and especially in relative shortness and width, in the deeper grooving of the trochlea, and in the incipient transformation of the inner condyle into the odontoid shape seen in *Megatherium*.

The calcaneum has a broad, depressed, plate-like tuber, not unlike that of the *Megalonychidæ*, but the sustentaculum is much more prominent and its astragalar facet presents dorsally, at right angles to the cuboid facet, instead of being almost parallel with it. The facet for the cuboid is remarkably narrow planto-dorsally, and below it is a thickened, callus-like mass of bone.

The ungual phalanges of the pes are less different from those of *Hapalops* than are the unguals of the manus; being shorter, more curved and compressed and more sharply pointed than the latter.

MEASUREMENTS.

Femur, length from head	.298	Tibia, distal thickness	.040
" " " great trochanter	.310	Fibula, estimated length	.218
" proximal width	.131	" width of shaft	.017
" distal width	.104	" thickness of shaft	.021
Tibia, length	.230	" distal width	.042
" proximal width	.104	" " thickness	.049
" " thickness	.071	Ilium, length	.162
" distal width	.079	" greatest width	.205

MYLODONTIDÆ.

In the Santa Cruz beds the representatives of this family are rare and most of the specimens are more or less fragmentary, so that our knowledge of these forms is still very incomplete. Except the skull, nothing is positively known concerning the skeletal structure of the Santa Cruz members of the family, but a few isolated vertebræ, limb and foot-bones have been found, which may, with great probability, be referred to it.

The family is most distinctively characterized by the teeth, which in the upper jaw are triangular, and in the lower jaw lozenge-shaped, while the last lower tooth is bilobate; the valleys are central and are usually enclosed in a continuous wall of the harder dentine. The teeth of each jaw are in continuous series and without diastema, and ^{1} is always implanted very far behind the anterior end of the maxillary. The forms of the teeth are subject to great variation, not infrequently differing on the two sides of the same jaw, and no two specimens are quite alike; slightly different modes of wear, which are doubtless individual, often give a very different appearance to the teeth.

In general appearance and proportions the skull is very similar to that of the Santa Cruz *Megalonychidæ*, though with a number of constant differences. The occipital crest is but slightly developed and the sagittal crest apparently not at all; the cranium is rounded and smooth, not flattened on top, as it is in *Mylodon*, nor having a narrow sagittal area, such as occurs in *Scelidotherium*. The parietals seem to have no sinuses and those of the frontals are very small; owing to the lower occiput and shallower facial region, the upper contour of the skull has a much more decided antero-posterior curvature than in either of the Pleistocene genera. The lachrymal has the same prominent, mammillary shape and funnel-like foramen as in the other two families. The face is elongate and very slender, and the rostrum may have parallel sides, or it may broaden anteriorly, though never so strongly as in *Mylodon*.

The mandible differs in a number of details from that of the other two families; the horizontal ramus has a nearly straight ventral border; the predental beak is long and deeply concave and has nearly parallel sides, with rounded or bluntly pointed anterior end. The condyle is placed upon a shorter neck than in the contemporary *Megalonychidæ*, but is raised higher above the level of the teeth, making the sigmoid notch shallower; the coronoid process is broader and less recurved and does not rise so high above the condyle; the angular process is shorter, but much broader dorso-ventrally, and thus the whole hinder portion of the jaw has a characteristic appearance. The postero-external opening of the dental canal is on the horizontal ramus below the base of the coronoid, and there is a single large and conspicuous mental foramen on each side of the predental beak, near the dorsal border.

The few known vertebræ differ but little from those of *Hapalops*. The limb-bones are short and heavy and the humerus, at least, has a decided resemblance to that of *Mylodon*, as is also true of the first metacarpal. The astragalus is characteristically different from that of either of the preceding families; it has much the same narrow, elongate shape as in the *Megalonychidæ*, but the inner condyle has already begun to assume the odontoid form and suggests that of *Mylodon*.

On account of the rarity and incompleteness of the material, the taxonomic subdivision of this family is an even more difficult task than in the case of the *Megalonychidæ*, and the difficulty is increased by the great variability in the forms of the teeth. Indeed no satisfactory arrangement is yet possible and the scheme here adopted is merely provisional. Ameghino has named four genera and nine species, but this seems to be an unnecessarily large number, and is almost equivalent to making a different species for every individual.

NEMATHERIUM Ameghino.

(Plates LXII; LXIII, Figs. 2–8.)

Nematherium Amegh.; Enum. Sistem. etc., 1887, p. 22.
Ammotherium Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 321.
Lymodon Amegh.; Ibid., p. 324.

The principal characteristic of this genus is the decided anterior divergence of the two dental series, which is displayed in both upper and lower jaws, and the consequent broadening of the palate forward, though it never approximates the condition seen in *Mylodon*. Within certain limits, the teeth vary much in shape; $^{\underline{1}}$ is usually cylindrical, though it may be triangular, and, in most instances, is bevelled by abrasion, but may be horizontally worn; the other upper teeth are triangular, varying much in proportions and in mode of wear; $^{\underline{2}}$, $^{\underline{3}}$ and $^{\underline{4}}$ are usually bevelled, but in some specimens they are almost horizontally abraded ; $^{\underline{3}}$ or $^{\underline{4}}$ is the largest of the series and $^{\underline{5}}$ the smallest and least distinctly triangular. Even more variable are the lower teeth ; $_{\overline{1}}$ is somewhat elongate antero-posteriorly, laterally compressed and of either triangular, or oval section, and usually with bevelled crown ; in several instances $^{\underline{2}}$ has worn a deep, step-like notch on the posterior side of $_{\overline{1}}$; $_{\overline{2}}$ and $_{\overline{3}}$ are four-sided and lozenge-shaped, with the long axis of the crown oblique to the line of the jaw ; $_{\overline{4}}$ is bilobate and very elongate antero-posteriorly ; the anterior lobe is transverse, but somewhat oblique, while the posterior lobe has a fore-and-aft direction, curving inward at the hinder end, and is convex externally and, except in one specimen, concave internally.

Aside from mandibles, the skull is known only from three specimens in the Ameghino collection, one of which, the type of *Ammotherium aculeatum* (Plate LXII, figs. 2, 2*a*, 2*b*) is quite complete and has the mandible, lacking the ascending ramus ; another, the type of *Lymodon perfectus* (Plate LXII, figs. 1, 1*a*) is the right half of a skull, without lower jaw ; the third, the type of *N. longirostris*, is very incomplete. The same collection contains also two palates, with teeth, referred respectively to *Ammotherium declivum* and *A. profundatum*, but these add little to our knowledge of the skull structure in the genus.

In proportions this skull does not differ at all radically from that of the Santa Cruz *Megalonychidæ*, the most striking distinction being the length and slenderness of the region in front of the brain-case. The occiput is broad, quite low, and inclined slightly forward ; the condyles are widely separated by a broad ventral notch and the paroccipital processes seem to be obsolete ; the occipital crest is inconspicuous and the supraoccipital is reflected well over upon the dorsal side of the cranium. The brain-case is full and rounded, without sagittal crest or area, narrowing regularly forward to the interorbital region ; the zygomatic arch is imperfectly known, but seems not to have been unlike that of *Hapalops*. The postorbital constriction is very shallow and inconspicuous and hence the long frontals have little of the hour-glass shape seen in the *Megalonychidæ*, and the sinuses produce no noticeable elevation of the forehead. In front of the postorbital constriction the skull is remarkably slender and elongate, one of the most characteristic differences from the two preceding families ; the maxillaries are produced far in front of the first tooth and the preorbital fossæ are very shallow, forming no distinct constriction when the skull is viewed from above or below; the maxillaries end abruptly at the anterior nares and have no such forward prolongation as do those of *Scelidotherium*. Posteriorly, the palate, which extends a short distance behind the last tooth, is very narrow and quite decidedly convex, broadening and flattening anteriorly between the divergent rows of teeth; at the front border is a narrow and deep V-shaped notch for the premaxillary spines; the facet for the external branch of the premaxillary is similar in shape and position to that of *Hapalops*.

Of the premaxillæ only the spines are known; but from the shape of the anterior ends of the maxillaries, the facets upon them, and from the predental beak of the mandible, the shape and size of these bones may be approximately determined. In all probability, the premaxillæ of *Nematherium* were, like those of *Mylodon*, each composed of two branches, one internal, or the spine, and the other external, but having no distinct anterior branch, such as is found in the Santa Cruz *Megalonychidæ;* they were more elongate than in *Mylodon*, very much less so than in *Scelidotherium*, but, as in the latter, the spines taper posteriorly to a point, filling the V-shaped notch in the palate. The posterior nares are narrow in front, broadening rapidly behind; the side-walls, formed by the pterygoids and alisphenoids, have much the same shape as in *Hapalops*.

The mandible, which is known only in this genus, not in the succeeding one, has already been described in the account of the family.

No vertebræ have yet been identified, except a few in connection with one individual (No. 15,893), the reference of which, though very probable, is not entirely certain, because no tooth or part of the skull is associated with the specimen. The posterior thoracic vertebræ resemble those of the Santa Cruz *Megalonychidæ* and have the centra perforated in the usual way by paired canals opening on the ventral surface; the caudal vertebræ also are not especially characteristic. On the other hand, the only lumbar associated with this specimen has a very peculiar type of transverse process, different from anything known in either of the preceding families; the process is quite short, but the distal portion is very broad antero-posteriorly; it is deeply notched on the anterior border and its base is perforated by a large vertical foramen; the shape of the process is thus deceptively like the inferior lamella of a cervical, except that it projects horizontally, not ventrally; the accessory articular processes are, as in *Hapalops*, a small anterior pair, placed on the neural arch below the true prezygapophyses, and a small posterior pair arising from the hinder edge of the transverse processes.

The humerus (Plate LXIII, figs. 6, 6^a, No. 15,374) was found isolated and is referred to the present genus because of its resemblance to that of *Mylodon* and its decided difference from the humeri of the two preceding families. Compared with the humerus of *Hapalops*, this specimen is strikingly short and heavy and all the processes for muscular and ligamentous attachment are more prominent; the proximal end is broader, owing to the development of the tuberosities, of which the internal is relatively larger and more prominent than in *Mylodon*, and the bicipital groove is shallow; the shaft is stout; the pectoral ridge is distinct and the deltoid area is much broader than in *Hapalops* and near the distal end its borders project more prominently; the supinator ridge and external epicondyle are much better developed than in *Hapalops* and the former has a greater proximo-distal extension than in *Mylodon*, making the musculo-spiral groove very conspicuous; the internal epicondyle is extremely large and is perforated by the usual large foramen. The trochlea is intermediate in character between that of *Hapalops* and that of *Mylodon*, differing from the latter in the narrow hemispherical facet for the radius and in the better definition of the groove on the posterior side for the ulna, and from the former in the flatness of the ulnar facet, which is hardly reflected at all upon the dorsal side; the anconeal fossa is small and shallow. The dimensions of this humerus are as follows:

Length	.160	Distal width over epicondyles	.072
Proximal width	.055	" " " trochlea	.042

The radius (Plate LXIII, figs. 7, 8; No. 15,893) is conspicuously short and stout and may be described as intermediate in character between *Hapalops* and *Scelidotherium*. The head, which is much damaged, appears to have been discoidal in shape; the bicipital tubercle is very large and rugged and has a slightly more distal position than in *Hapalops;* the proximal part of the shaft is broader and shorter than in the last named genus, but has a similar shape, while the distal broadening, though more gradual, is much greater, and the external border is more thickened; the carpal surface is larger in both dimensions and the styloid process is somewhat more pronounced. The length of this radius is 123 mm., and its distal width is 30 mm.

The first metacarpal is characteristically like that of *Mylodon*, though it is relatively longer and more slender. Owen's description of this bone in the Pleistocene genus applies almost exactly to *Nematherium;* it "presents a very singular and anomalous figure, in consequence of a thick and short process which is sent off from the ulnar side of its base, which gives it the appearance of being bent at a right angle" ('42, 90–91). This process, though not so long as in *Mylodon*, is very conspicuous and gives to this metacarpal an entirely different appearance from that of the Santa Cruz genera of the *Megalonychidæ* and *Planopsidæ*. Other differences which this specimen displays from the first metacarpal of *Mylodon* are the concave instead of the plane facet for the trapezium, the longer and more slender shaft, and the well developed distal trochlea, with its prominent keel. The dimensions are as follows: Length, 26 mm.; proximal width, 18 mm.; distal width, 9 mm.

A third individual (No. 15,965, text figure 38), which consists of the astragalus, navicular, part of the calcaneum, and the distal end of the fibula, is referred, with some hesitation, to *Nematherium*, chiefly because of its marked difference from the two preceding families, and a certain likeness to *Mylodon*. The distal end of the fibula is a very massive external malleolus, much like that of *Hapalops*, but with a somewhat larger facet for the tibia. The astragalus has a narrow, elongate form, quite similar to that of the *Megalonychidæ*, but a marked and suggestive likeness to *Mylodon* is seen in the trochlea; the inner condyle has a very distinct tendency to assume the odontoid shape and is much less extended proximo-distally than the external condyle. In the astragalus of *Prepotherium*

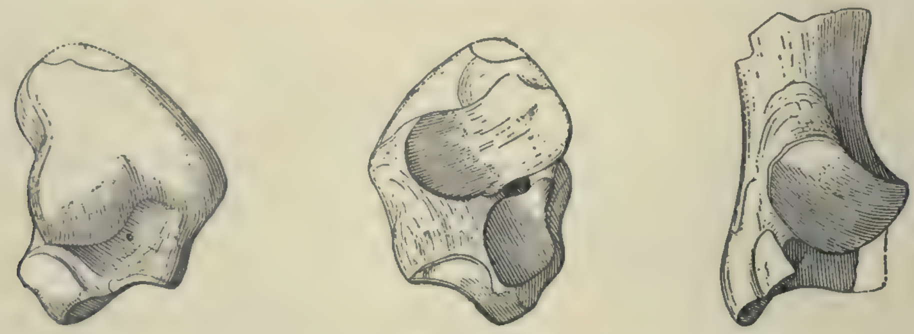


FIG. 38.

Nematherium sp. Left astragalus, dorsal and ventral views and left calcaneum, dorsal view, × 1/1. No. 15,965.

also the inner condyle has begun to be odontoid in form, but in quite a different fashion and without any likeness to *Mylodon*. Another difference from the astragalus of the *Megalonychidæ*, seen in that referred to *Nematherium*, is the division of the internal calcaneal facet into two distinct surfaces, which are almost at right angles to each other, while the cuboid facet is smaller and the navicular facet is shallower. This astragalus measures 35 mm. in length and 27 mm. in greatest width.

The navicular resembles that of *Hapalops*, except that the inner border is somewhat less produced proximally. In the fragment of the calcaneum the only noteworthy feature is the presence of a second internal astragalar facet, corresponding to the division of the inner calcaneal surface of the astragalus.

Relationships. — The materials for the study of *Nematherium* are tantalizingly incomplete and entirely insufficient for any final determination of its taxonomic position. However, so far as this material goes, it is all in favor of the conclusion that this genus is a forerunner and quite possibly an actual ancestor of *Mylodon*, while its reference to the family of the *Mylodontidæ* appears not to be open to question. The resemblances to *Mylodon* are especially marked in the scanty remnants of the limbs and feet, which are just what we should expect to find in an ancestor of that genus, while the anterior broadening of the palate and rostrum, though not at all striking, is another significant resemblance. At the same time, we find many points of similarity between *Nematherium* and *Scelidotherium*, especially in the characters of the teeth and skull, so that much might be said in favor of regarding the Santa Cruz genus as nearly, if not quite, representing the common ancestor of the two Pleistocene genera. Even though the relationship between the earlier and the later genera should prove not to be so simple and direct as is here assumed, these Santa Cruz species would not be without importance, because they would then represent what might be called arrested stages in the development of the family, which, as Tournouet has shown ('03), was already in existence in pre-Patagonian times.

While the resemblance of *Nematherium* to *Mylodon* and the propriety of referring the former to the *Mylodontidæ* are sufficiently obvious, it is of interest, on the other hand, to observe the many likenesses to the contemporary members of the *Megalonychidæ* and the *Planopsidæ*. So many and so close are these likenesses that, if the Santa Cruz genera of the

Gravigrada were now living, we might well include them all in a single family. In the structure of the skull, the vertebral column, the limbs and feet, there is a remarkable uniformity of plan throughout all the genera, and this uniformity is clearly to be interpreted as indicating the common origin of the three families and the relatively small degree of divergence which they had attained in the Santa Cruz epoch, as compared with the differences which separated their Pleistocene representatives.

NEMATHERIUM ANGULATUM Ameghino.

(Plates LXII, Fig. 3; LXIII, Figs. 3–5*a*.)

Nematherium angulatum Amegh.; Enumeracion sistematica, etc., 1887, p. 22.

Nematherium sinuatum Amegh.; Ibid.

Nematherium longirostris Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 324.

Nematherium lavagnanum Mercerat; Rev. del Mus. de La Plata, T. II, 1891, p. 26.

This, the typical and most abundant species, is of medium size and is characterized by a certain degree of constancy in the forms of the teeth, though there is much variability also. In the upper jaw ^{1} is subcylindrical, $^{2-4}$ are distinctly triangular and bevelled by wear, with a smaller anterior and larger posterior worn surface; ^{5} is horizontally worn and less distinctly triangular than ^{2} or ^{3}. In the mandible $_{1}$ is triangular, $_{2}$ and $_{3}$ are quadrangular and lozenge-shaped and $_{3}$ is more elongate antero-posteriorly; $_{4}$ is bilobate, but no two specimens agree in the relative size of the two lobes, which is often different on the two sides of the same mandible. The anterior divergence of the two rows of teeth is more decided than in some of the other species. Of the skull only one imperfect specimen is known and that displays little that is characteristic. The mandible has a long, obtusely pointed predental beak, the dorsal border of which is raised above the level of the teeth; the ascending ramus is broad and the coronoid erect.

In the following table the measurements are from the type of *N. longirostris* in the Ameghino collection.

MEASUREMENTS.

Upper dentition, length	.042
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.005
" width (*i. e.*, transverse diameter)	.0055
$^{\underline{2}}$, length	.007
" width	.005
$^{\underline{3}}$, length	.008
$^{\underline{3}}$, width	.007
$^{\underline{4}}$, length	.008
" width	.007
$^{\underline{5}}$, length	.007
" width	.005
Palate, width at $^{\underline{1}}$	.016

In the succeeding measurements No. 1 is the type of *N. lavagnanum* in the La Plata Museum.

	No. 1.	*No. 15,530.*
Lower dentition, length	.040	.0385
$_{\overline{1}}$, length	.008	.008
" width	.005	.005
$_{\overline{2}}$, length	.0085	.008
" width	.006	.006
$_{\overline{3}}$ length	.009	.009
" width	.0065	.0065
$_{\overline{4}}$, length	.013	.0125
" width	.007	.006
Width of jaw between $_{\overline{1}}$		.016
" " " " $_{\overline{4}}$		.010
Mandible, depth at $_{\overline{4}}$	.0264	.026
" height of coronoid		.059
" length of predental beak		.037

NEMATHERIUM AUCA (Ameghino).

(Plate LXII, Figs. 1, 1^a, 6.)

Lymodon auca Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 324.
Lymodon perfectus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 166.

The type of *Lymodon auca* is an imperfect mandible and that of *L. perfectus* is the right half of the skull, with teeth; the two specimens agree so well that they might almost pertain to the same individual. This species is one of the largest Santa Cruz representatives of the present family; the teeth are horizontally abraded, with some slight indications of bevelling on one or more of them; $^{\underline{1}}$ is nearly cylindrical, though somewhat flattened on the inner side; $^{\underline{2-5}}$ are very obscurely triangular, almost trapezoidal. In the mandible, $_{\overline{1}}$ is triangular, with the apex behind; $_{\overline{2}}$ and $_{\overline{3}}$ are also triangular, but much compressed antero-posteriorly, broad transversely and set obliquely to the line of the jaw; $\overline{4}$ has an unusually long posterior lobe.

The skull, so far as it is preserved, differs little from that of other members of the family; its upper contour is regularly arched from the occiput to the end of the muzzle, and the preorbital region is quite short; the facet for the jugal on the maxillary is an unusually large and deep, triangular depression.

The measurements in the subjoined table are from the types in the Ameghino collection.

MEASUREMENTS.

Upper dentition, length	.056
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.010
" width (*i. e.*, transverse diameter)	.007
$\underline{2}$, length	.010
" width	.008
$\underline{3}$, length	.0105
" width	.0095
$\underline{4}$, length	.010
" width	.0085
$\underline{5}$, length	.0085
$\underline{5}$, width	.007
Skull, length	.210
Lower dentition, length	.056
$\overline{1}$, length	.0065
" width	.006
$\overline{2}$, length	.006
" width	.008
$\overline{3}$, length	.006
" width	.0095
$\overline{4}$, length	.020
" width	.011

NEMATHERIUM PROFUNDATUM (Ameghino).

(Plate LXII, Figs. 2–2^b; Plate LXIII, Fig. 2.)

Ammotherium profundatum Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 325.

Ammotherium aculeatum Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 168.

The type of *Ammotherium profundatum* is the nearly complete mandible of a rather old individual, with all the teeth in place, while that of *A. aculeatum* is a finely preserved skull, with lower jaw, but lacking the ascending ramus. There are, it is true, many differences between the two specimens, but, in view of the great variability which characterizes this whole group, it seems hardly probable that they represent two distinct species. On the other hand, the palate with teeth which Ameghino subsequently referred to *A. profundatum* ('94, 168) (Plate LXII, fig. 5) may well pertain to a different species.

In size, this is one of the largest of the Santa Cruz *Mylodontidæ*, though somewhat smaller than the preceding species. In the type of *A. aculeatum*

$^{\underline{1}}$ is of compressed elliptical section and of remarkably small size, while $^{\underline{2-4}}$ are of unusually well-defined triangular form, and $^{\underline{5}}$ is less distinctly so. The two series of upper teeth diverge anteriorly in only a moderate degree, while in the palate above mentioned the divergence is much more decided and $^{\underline{1}}$ is large and triangular. In the mandibular dentition there is considerable difference between the types of *A. profundatum* and *A. aculeatum*, and even on the opposite sides of the same jaw. In the former $_{\overline{2}}$ is more cylindrical and $_{\overline{3}}$ more antero-posteriorly compressed, while in the latter $_{\overline{2}}$ is more triangular and $_{\overline{4}}$ has a remarkably broad posterior lobe; in both $_{\overline{1}}$ is of compressed elliptical section and has a large, deeply notched surface of abrasion on the hinder face.

The skull, as displayed in the type of *A. aculeatum*, is very elongate and quite broad posteriorly, the cranium reaching its maximum width at the glenoid cavity, and thence narrowing to the interorbital region, while the face is very slender, though the rostrum broadens somewhat anteriorly. The occiput is low and the upper contour of the skull, which rises but little to the parietal eminence, has a nearly horizontal and slightly sinuous course. The basioccipital and basisphenoid are very broad; the condyles are quite small and are separated ventrally by a wide and deep notch. The preorbital region is somewhat longer than in any other species; the palate is very narrow and quite strongly convex behind, widening and flattening anteriorly, and is continued for a short distance behind the last tooth; the median notch for the premaxillary spines is a deep and narrow V. The posterior nares follow the shape of the cranium, being very broad behind, contracting forward and becoming very narrow at the front border. The mandible is best shown in the type of the species, in which it differs in a number of respects from that of *N. angulatum;* the coronoid is more recurved and inclined; the condyle is placed upon a longer neck and is more raised above the level of the teeth, while the angular process appears to have been much longer. In the type of *A. aculeatum*, the predental beak has more nearly parallel sides and an elevated dorsal border.

In the following table No. 1 is the type of *Ammotherium profundatum*, No. 2 the palate referred to the same species, and No. 3 the type of *A. aculeatum*, all in the Ameghino collection.

MEASUREMENTS.

	No. 1.	*No. 2.*	*No. 3.*
Upper dentition, length		.046	.045
$\underline{1}$, length (*i. e.*, antero-posterior diameter)		.007	.0062
" width (*i. e.*, transverse diameter)		.0065	.0038
$\underline{2}$, length		.009	.0075
" width		.008	.0062
$\underline{3}$, length,		.007	.0075
" width		.009	.0075
$\underline{4}$, length		.008	.007
" width		.0075	.0075
$\underline{5}$, length		.007	.0075
" width		.006	.0062
Lower dentition, length	.044		.042
$\overline{1}$, length	.0075		.008
" width	.006		.005
$\overline{2}$, length	.007		.0065
" width	.006		.006
$\overline{3}$, length	.007		.008
" width	.0075		.007
$\overline{4}$, length	.014		.014
" width	.009		.0085
Skull, length in median basal line, excluding premaxillæ.			.159
Skull, length condyle to anterior nares			.184
Cranium, length condyle to rim of orbit			.1375
Face, length orbit to anterior nares			.0465
Occiput, height			.046
" width			.060
Zygomatic arch, length			.089
Distance, occipital condyle to glenoid cavity			.034
Palate, length in median line			.061
" width at $\underline{1}$		.019	.017
" " " $\underline{5}$		.010	.009
Mandible, length from condyle	.157		
" " of predental beak	.051		.044 +
" depth below $\overline{4}$	.032		.0285
" height of coronoid	.070		
" " " condyle	.060		

NEMATHERIUM DECLIVUM (Ameghino).

(Plate LXII, Figs. 4, 4ᵃ.)

Ammotherium declivum Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 168.

This doubtful species, which is known only from the type, is the smallest of the genus, though not much inferior to the smaller specimens of *N. angulatum*.

MEASUREMENTS.

Upper dentition, length	.037	Lower dentition, length	.036
$\underline{1}$, length (*i. e.*, antero-posterior diameter)	.0045	$\overline{1}$, length	.007
" width (*i. e.*, transverse diameter)	.004	" width	.004
$\underline{2}$, length	.007	$\overline{2}$, length	.006
" width	.0055	" width	.005
$\underline{3}$, length	.007	$\overline{3}$, length	.0075
" width	.007	" width	.0055
$\underline{4}$, length	.007	$\overline{4}$, length	.013
" width	.0055	" width	.005
$\underline{5}$, length	.0065	Palate, width at $\underline{1}$	.015
" width	.004	" " " $\underline{5}$	.009

ANALCITHERIUM Ameghino.

Analcitherium Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 325.

Scelidotherium Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 92.

The separation of this genus from *Nematherium* may prove to be unnecessary, but, for the present at least, seems to be advisable, because of its greater likeness to *Scelidotherium*, which has led Lydekker to refer it to the latter. The most important distinction from *Nematherium* consists in the much less decided anterior divergence of the dental series and the parallelism of the sides of the rostrum, while the preorbital region is relatively short.

Assuming the propriety of separating this form generically, it seems probable that it is more particularly related to *Scelidotherium*, as *Nematherium* is to *Mylodon*.

ANALCITHERIUM ANTARCTICUM Ameghino.

(Plate LXIII, Figs. 1, 1^a.)

Analcitherium antarcticum Amegh.; Rev. Argent. de Hist. Nat.. T. I, 1891, p. 325.

Scelidotherium antarcticum Lydekker; Anales del Museo de La Plata T. III, 1894, p. 92.

The typical and only known specimen is the skull, lacking the occiput, basis cranii, zygomatic arches, and mandible, of a very young animal, and certain of its characteristics may be due to immaturity. The anterior upper teeth ($^{\underline{1}}$ and $^{\underline{2}}$) are of compressed, subelliptical shape, flattened on the inner side; $^{\underline{3}}$ and $^{\underline{4}}$ are triangular, with rounded angles, and $^{\underline{5}}$ is obscurely so; the two dental series are nearly parallel, with only a slight anterior divergence.

The skull is very similar to that of *Nematherium* in form, being broad behind, contracting rapidly forward to the interorbital region, and with elongate and very slender face. The occiput is low and the upper contour of the skull is gently arched from before backward; the preorbital portion of the face is distinctly shorter than in any species of *Nematherium* in which the skull is well known, and the predental part of the maxillary is also shortened; the palate is of nearly uniform width and but slightly convex posteriorly, where it is not continued so far behind the last tooth as in the preceding genus.

MEASUREMENTS.

Upper dentition, length	.039
$^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.006
" width (*i. e.*, transverse diameter)	.0045
$^{\underline{2}}$, length	.007
" width	.005
$^{\underline{3}}$, length	.0065
" width	.0065
$^{\underline{4}}$, length	.008
" width	.007
$^{\underline{5}}$, length	.006
" width	.004
Skull, length occiput to anterior nares	.150
Cranium, length to rim of orbit	.114
Face, length orbit to anterior nares	.036
Occiput, height	.031
Cranium, width at glenoid cavity	.052
Zygomatic arch, length	.075
Rostrum, width at infraorbital foramina	.024
" " " anterior end	.021
Palate, length in median line	.047
" width at $^{\underline{1}}$	.0135
" " " $^{\underline{5}}$	.010

EDENTATA INCERTÆ SEDIS.

In addition to the foregoing genera Ameghino has named a number of others, some of which he has referred to the Monotremata. These genera are very imperfectly known and, as I am not in a position to add anything to what has already been published, merely the names and references are here given.

TREMATHERIUM Ameghino.

Trematherium Amegh.; Énum. Sistem. etc., 1887, p. 22.

Trematherium Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 319.

Schismotherium Mercerat, in part; Rev. del Museo de La Plata, T. II, 1891, p. 5.

Trematherium Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 169.

Trematherium Amegh.; Sec. Censo de la Repúb. Argent. T. I, 1898, p. 209.

TREMATHERIUM INTERMIXTUM Ameghino.

Trematherium intermixtum Amegh.; Énum. Sistem. etc., 1887, p. 22.

Schismotherium intermixtum Mercerat; Rev. del Museo de La Plata, T. II, 1891, p. 8.

Planops longirostratus Mercerat, in part, Ibid., p. 8.

Trematherium intermixtum Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 159.

Trematherium intermixtum Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 209.

TREMATHERIUM NANUM Ameghino.

Trematherium nanum Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 319.

Trematherium nanus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 170.

Trematherium nanum Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 209.

ADIASTALTUS Ameghino.

Adiastaltus Amegh.; Révue Scientifique, T. LI, 1893.

Adiastaltus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 184.

Peltephilus Lydekker, in part.; Anales del Museo de La Plata, T. III, 1894, p. 67.

Adiastaltus Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 225.

ADIASTALTUS HABILIS Ameghino.

Adiastaltus habilis Amegh.; Révue Scientifique, T. LI, 1893.

Peltephilus strepens Lydekker, in part; Anales del Museo de La Plata, T. III, 1894, p. 68.

Adiastaltus habilis Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 184.

Adiastaltus habilis Amegh.; Sec. Censo de la Repúb. Argent.; T. I, 1898, p. 225.

ADIASTALTUS PROCERUS Ameghino.

Adiastaltus procerus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 186.

Adiastaltus procerus Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 225.

PLAGIOCŒLUS Ameghino.

Plagiocœlus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 186.

PLAGIOCŒLUS OBLIQUUS Ameghino.

Plagiocœlus obliquus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 187.

ANATHITUS Ameghino.

Anathitus Amegh.; Révue Scientifique, T. LI, 1893.

Anathitus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 187.

Anathitus Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 225.

ANATHITUS REVELATOR Ameghino.

Anathitus revelator Amegh.; Révue Scientifique, T. LI, 1893.

Anathitus revelator Amegh.; Énum. Synopt. des Mamm. Foss. d. Patagonie, 1894, p. 187.

Anathitus revelator Amegh.; Sec. Censo de la Repúb. Argent., 1898, p. 225.

ENTELOPS Ameghino.

Entelops Amegh.; Enumeracion sistematica, etc., 1887, p. 23.

Entelops Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Arg., 1889, p. 654.

Entelops Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 109.

Entelops Amegh.; Sec. Censo de la Repúb. Argent., T. I, 1898, p. 209.

ENTELOPS DISPAR Ameghino.

References as for the genus.

RELATIONSHIPS OF THE EDENTATA.

It must be admitted that the Santa Cruz fossils throw but little light upon the very obscure and difficult problems concerning the origin of the Edentata and their relations to other mammalian groups. Such light can be obtained only from a fauna of much more considerable geological antiquity, though, if the exceedingly curious animals, which Ameghino has described as *Adiastaltus* and *Anathitus* and referred to the Monotremata, were better known, they might afford a valuable clue to the solution of the mystery. So far as it goes, the evidence of the Santa Cruz fauna is not in favor of Wortman's most interesting hypothesis ('96, '97) that the Edentata were derived from the Ganodonta. This hypothesis rests chiefly upon a series of resemblances between the latter group and the Pleistocene genus *Megalonyx*, and more especially upon the identification of the first tooth in each jaw of the Gravigrada as a canine. Even in regard to the upper tooth this identification is exceedingly doubtful, and there is much more reason to consider the tooth a premolar. In the case of the lower tooth, however, the determination is clear, for this tooth, almost without exception, bites *behind* the upper caniniform and therefore cannot itself be a true canine. More important is the fact that the Santa Cruz Gravigrada are less like the Ganodonta than are the Pleistocene genera, which of course would not be the case if the Ganodonta were the true ancestral group; we should then find that the farther back the edentate line were traced, the more closely it would approximate the ganodonts. Wortman too is quite mistaken in supposing that the earliest appearance of the edentates in South America "does not antedate the Santa Cruz epoch" ('97, 104). On the contrary, they occur in the oldest known Tertiary, and possibly even pre-Tertiary, deposits of Patagonia, and there is every appearance of their having been indigenous in that region. It cannot be pretended that the evidence of the Santa Cruz fauna definitely disproves Wortman's hypothesis, but it does render it distinctly less probable. On the other hand, Osborn's recent discovery of a true armadillo in the Bridger Eocene of North America ('04), removes the formidable geographical difficulty which had formerly attended that hypothesis.

Although the Santa Cruz fauna thus gives us little help in determining the relationships of the Edentata to other mammalian orders, it affords abundant testimony to the unity of origin of the American edentates.

The so-called edentates of the Old World have very little in common with the American orders and probably are not related to them. At all events, the Santa Cruz fossils do not even tend to bridge the gap between the two series.

As was pointed out in a previous section (this volume, p. 4), there is strong reason to believe that all of the edentate orders had come into existence as such before Santa Cruz times, although no representatives of the ant-eaters or of the true sloths (Tardigrada) have yet been found in the Santa Cruz or older formations. It is doubtless true of those two orders, as it is of the three others, Dasypoda, Glyptodontia and Gravigrada, which are well represented in the Miocene fauna, that at that time the various subdivisions of the edentates had not yet become so widely separated by divergent evolution as they afterwards were. In other words, as we trace these groups backward in time, we find them converging more and more closely to a common term, and this is a highly significant fact, as indicating their monophyletic origin from a single ancestral group.

It further appears probable that the five orders, or suborders, of the Edentata did not arise simultaneously from the hypothetical ancestral group, but that the first division was into two principal branches. One of these branches subsequently gave off the armadillos and glyptodonts, while the other divided into the ground sloths, ant-eaters and true sloths. This conclusion is indicated by a comparison of the Santa Cruz armadillos and glyptodonts, on the one hand, with those of the Pampean, on the other, which shows not only that these two orders were much nearer together in the former epoch than in the latter, but also that they were more like each other than either is like any other order of edentates. This resemblance is by no means confined to the presence of a dermal armor in both groups, but extends to nearly all parts of the skeleton and even, in some small degree, to the dentition, and justifies the inclusion of both orders in the higher group *Loricata*.

It would be very interesting to learn whether the earliest edentates possessed dermal ossifications. That such was the case, is rendered to a certain extent probable by the presence of these ossifications in the Pleistocene *Mylodontidæ*. On the other hand, no trace of armor has been found in association with any of the Santa Cruz Gravigrada, though the extremely scanty and imperfect remains of the *Mylodontidæ* in the beds of that epoch deprives this fact of importance, so far as that particular family is concerned. For the *Megalonychidæ* and *Planopsidæ*, the number of well preserved skeletons and parts of skeletons already collected is so large as to make the negative evidence very strong. If the ancestors of the Gravigrada had dermal ossifications, these ossifications had been lost in all except one family before the Santa Cruz epoch. It is of course possible that the dermal armor was independently acquired by the *Mylodontidæ* and at a comparatively late period. Materials are lacking for a definite decision between these two alternatives, though perhaps the least unlikely assumption is as follows: That the single ancestral group of American edentates possessed dermal ossifications which were not exposed on the surface or covered merely with epidermal scales, but concealed within the skin, which was covered with hair; that in the Loricata they gradually assumed the forms so familiar in the glyptodonts and armadillos, while in the other orders they were lost, except in a single family of the Gravigrada.

In the absence of the ancestral forms of the true sloths and the ant-eaters, it is difficult to reach any definite conclusions concerning the second great branch of the American edentates, though it is possible to draw a number of probable inferences from a study of the Santa Cruz Gravigrada. As has been shown in detail in the preceding pages, the skeleton of these animals is very much less specialized than it became in their Pleistocene successors and, what is of particular significance, the Santa Cruz ground sloths are very much closer to the ant-eaters in structure than are those of the Pampean beds. Aside from the skull, all parts of the skeleton, the vertebral column, the limb-girdles, limbs and feet display this resemblance in a very marked manner, and it seems hardly open to question that the Vermilingua and the Gravigrada had a common ancestry, a conclusion which was long ago reached by Flower ('76) though upon somewhat different grounds. The skull is, of course, very different in the two groups, but the differences are not of such a kind as to preclude the common origin of both.

Even more closely connected are the Gravigrada and the Tardigrada; the resemblance is most clear in the dentition and skull, but there are also many points of likeness throughout the skeleton. That the skeleton of the Tardigrada should be extremely peculiar, is not surprising in view of their very unusual habits; the weight of the body is *suspended* from the limbs, not carried upon them in the ordinary fashion, and thus the mechanical character of the stresses is altered and what is normally compression becomes tension. The entire bony structure is modified in accordance with this most exceptional arrangement and yet, in spite of this great modification, there are many notable resemblances between the modern Tardigrada and the Santa Cruz Gravigrada, so many as to render it altogether probable that both orders were derived from a single ancestral type.

The backward convergence in time of the edentate orders is even more conspicuously shown by the families within those orders. All the Santa Cruz glyptodonts are very closely similar and the only reason for grouping them into distinct families is because they seem to show, in an incipient and inconspicuous way, the first stages of those differences which became so very much more distinct in the subsequent epochs. Similarly, the three families of the Gravigrada were, in Santa Cruz times, very closely alike to one another, differing only in details of a very minor kind. Had the ground-sloths become extinct at the end of the epoch, instead of persisting till a much later time, no division into families would seem to be necessary, for the differences are significant only as foreshadowing the far more important differences of subsequent epochs.

In the case of the armadillos the evidence is less satisfactory, for the Santa Cruz beds have as yet yielded the probable ancestor of only a single modern genus, while those of other recent families and genera must, it seems likely, be sought in a different region. Taken as a whole, however, the testimony of the Santa Cruz fauna to the unity and close relationship of all the American edentates, is very cogent.

PART II. INSECTIVORA.

At the present time continental South America contains no representative of the Insectivora. Unusual interest therefore attaches to Ameghino's discovery of the genus *Necrolestes* in the Santa Cruz beds, which was announced in 1891. In his first account Ameghino suggested that this curious fossil had analogies with the Cape golden moles of Africa (*Chrysochloridæ*), but in a second paper (1894) this suggestion is not repeated and the genus is referred to a new family, the *Necrolestidæ*. The material collected by Messrs. Hatcher and Peterson adds largely to our knowledge of this genus and the result of a comparison with the skeletons of *Chrysochloris* and the Marsupial *Notoryctes* is to confirm Ameghino's original suggestion of a relationship between the African genus and *Necrolestes*. The new family name is, however, provisionally retained, because it would be premature, and perhaps entirely misleading, to refer the fossils to the existing family.

NECROLESTIDÆ.

NECROLESTES Ameghino.

(Plate LXIV, Figs. 1–5.)

Necrolestes Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 303.

The dental formula is $I\frac{4}{4}$, $C\frac{1}{1}$, $P\frac{3}{3}$, $M\frac{3}{3}$. In the upper jaw the incisors diminish in size, though not regularly, from the median to the lateral one; i^2 is nearly and sometimes quite as large as i^1, while i^3 is smaller and i^4 considerably smaller than the anterior pair; i^1 is slightly recurved and antero-posteriorly compressed, giving it some resemblance to a very short rodent tooth, while the others are laterally compressed. Viewed from the outer side, the crowns of all the incisors have a rectangular, almost square shape and those of i^1 and ^{2} are faintly grooved; each incisor is carried on a single fang. In *Chrysochloris* the incisors are three in number; i^1 is much enlarged and i^2 and especially i^3 much reduced; the crowns are acutely pointed and minute accessory basal cusps are present in some of the species. *Notoryctes* has greatly reduced incisors, which in their quadrate form bear a certain resemblance to those of *Necrolestes.*

The canine is much the largest and most prominent tooth of the upper jaw; at the base the crown is broad and thick, but it tapers rapidly to an acute point; in shape, it is obscurely trihedral, with flattened anterior and grooved inner faces, and sharp posterior edge; the whole tooth is somewhat recurved. The great size of the canine is in marked contrast to both *Chrysochloris* and *Notoryctes*, in which this tooth is much reduced and smaller than any of the incisors.

The premolars are three in number, and only the anterior one, probably p^2, differs appreciably from the molars in structure; it is inserted by two fangs and has an acutely pointed, compressed-conical crown, with trenchant anterior and posterior edges and small anterior basal cusp. The succeeding five teeth are alike except in size, with trigonodont crowns, which closely resemble those of *Chrysochloris*, but are less completely hypsodont and lack the pointed, cusp-like pillar which, in the recent genus, arises from the inner apex of the triangle. As in the latter, p^4 is the largest of the grinding teeth, the molars diminishing in size posteriorly; m^3 is very small, though not so minute as in *Chrysochloris.* In *Notoryctes* the premolars are very small and simple.

In the lower jaw the four single-rooted incisors have laterally compressed quadrate crowns and decrease in size from $i_{\overline{1}}$ to $i_{\overline{4}}$. In *Chrysochloris* $i_{\overline{1}}$ is very small and $i_{\overline{2}}$ the largest of the series, and the crowns of all three are more curved and pointed, less compressed than in the fossil, while in *Notoryctes* these teeth are almost rudimentary. The canine is very large and has a high, broad, trenchant, recurved and acutely pointed crown, which, when the mouth is closed, is received into a deep notch in the side of the upper jaw. Ameghino states that this tooth is implanted by two roots, which in the individual figured by him ('94ª, 107, fig. 43) are very greatly swollen; in none of the specimens of the Princeton collection are the fangs so much swollen, though one of them is not very different in this respect. In *Chrysochloris* the lower canine is smaller than $i_{\overline{3}}$ and in *Notoryctes* it is greatly reduced.

The foremost premolar ($p_{\overline{2}}$) resembles p^2 in form, but has both anterior and posterior basal cusps. The next five teeth ($p_{\overline{3}}$–$m_{\overline{3}}$) differ from one another only in size; they are trigonodont and hypsodont, much like those of the African genus, but not so high and somewhat longer antero-posteriorly, while $m_{\overline{3}}$ is less reduced. In all the grinding teeth, upper and lower, the cusps are early worn away, leaving more or less cordiform masticating surfaces (Pl. LXIV, Fig. 3^b).

As a whole, the dentition is both like and unlike that of *Chrysochloris;* the likeness is in the grinding teeth, the only noteworthy differences here being the less completely hypsodont character, the absence of the internal pillar in the upper teeth and the less extreme reduction of m3 in both jaws. The unlikeness is in the incisors, canines and foremost premolar, which in *Chrysochloris* are all small and of similar form. In *Notoryctes* the molars resemble those of the other two genera, but all the antemolars are minute and have evidently been much reduced.

The skull of *Necrolestes* is very similar indeed to that of *Chrysochloris* and although it is, in most respects, less modified and peculiar and in a few points more so, it is of an identical structural type. The skull is longer and more tapering anteriorly than in the modern genus, and the muzzle is prolonged in front of the incisors into a long, tapering, and upturned snout, which gives a very peculiar appearance to the whole head, almost equally different from the short, broad, and abruptly truncated muzzle of *Notoryctes* and the longer, narrower muzzle of *Chrysochloris*; the premaxillaries do not display the curious expansions seen in the latter, though this difference is apparent rather than real, for the processes are concealed by the prolongation of the nasals, while in *Chrysochloris* the shortened nasals leave them exposed. As in the African genus, the occiput is a broad, hemispherical swelling, somewhat less inflated, however, and without so distinct a depression in the median vertical line. A very short, but broad and distinct paroccipital process is present and encloses a deep fossa immediately behind the glenoid cavity. The occipital condyles are notably large, especially in the transverse direction and the foramen magnum presents less ventrally than in *Chrysochloris.*

One very marked difference from the modern genus consists in the very much less inflated and swollen character of the squamosal. In *Chrysochloris* this bone, seen from the front, looks like a sphere attached to the side of the cranium, most of it internal to the zygomatic arch, but in the fossil there is no such appearance. The zygomatic arch is long and quite distinctly heavier than in *Chrysochloris*, but its root is not so expanded into a vertical crest as in the latter, in which these processes have a peculiar appearance of enfolding the skull and make the temporal fossæ very narrow and deep. In *Necrolestes* the roots of the zygomata are normal in character, and the arches curve upward more decidedly than in the existing genus, in which they are very slender and almost straight. The glenoid cavity resembles that of the latter, but is somewhat larger and more deeply concave. The tympanic bulla is ossified and moderately inflated, though all the specimens are so damaged in this region of the skull as to render this determination slightly uncertain.

The sagittal crest is very inconspicuous but it is longer and more distinct than in *Chrysochloris*; the occipital crest, on the other hand is a mere raised line and is much less elevated than in the latter. The cranium has not the straight, tapering tubular form characteristic of *Chrysochloris*, but is broader and has a faintly marked postorbital constriction, which is more distinct than in those species of *Chrysochloris* which possess it at all (*C. rutilans*, *C. aurea*). A very slight angulation of the frontal represents the postorbital process, but it is hardly worthy of the name, and there is no corresponding process on the jugal.

The nasals are long and tapering and at their anterior ends they are upturned in a curious fashion, so as to make their dorsal surfaces strongly concave. Thinking at first that this appearance might, at least in part, be due to distortion from pressure, I have examined with great care the specimen which displays this character and have reached the conclusion that the character is a natural one, though in a second individual it is not apparent and even the prolongation of the muzzle is lacking. This latter skull, however, has evidently been flattened by pressure normal to its upper surface and the snout appears to have been broken off just in front of the premaxillary alveoli, and although it is possible that a specific or even a generic difference may here be indicated, yet the agreement of the two specimens is otherwise so close and exact that such a difference does not seem likely. The premaxillaries are elongate antero-posteriorly and are completely fused in the median line. From the dorsal border of the horizontal ramus arises a slender, pointed, median spike, which extends obliquely upward and forward more than half way to the nasals and incompletely divides the anterior nares into two distinct openings, which present forward and very slightly downward.

The maxillary is long and low and has a conspicuous preorbital prominence, formed by the alveolus of the large canine; in front of this swelling, and made all the more obvious by the juxtaposition, is a deep constriction, or notch, which receives the lower canine when the jaws are closed. The bony palate differs in several important respects from that of *Chrysochloris*, though having a similar general character and shape, since it does not take part in the snout-like prolongation of the muzzle, which is all in front of the incisors and is formed chiefly by the nasals. The incisive foramina are conspicuous and are long, narrow slits, running nearly the whole length of the palatine processes of the premaxillaries and separated by a slender spine. In *Chrysochloris* these foramina are either obsolete or exceedingly minute. The maxillary portion of the palate is broad and is traversed by obscurely marked, curved ridges, with the convexity turned forward, these ridges resemble and doubtless correspond to those of the soft palate. The posterior nares have the same relative position as in the African genus, but are rather higher and broader and they are divided into two openings by an extension of the vomer throughout their length, which descends to the level of the bony palate and is united with the palatines in the median line of the front margin of the narial opening, making the vomer appear like a process of the palatines. This extension of the vomer is not found in *Chrysochloris*. The pterygoid fossæ are not completely suppressed, as in the latter genus, but are represented only by shallow and inconspicuous grooves.

The mandible is exceedingly like that of *Chrysochloris*, so much so as immediately to suggest a relationship between the two genera, but it differs in a few minor details. The horizontal ramus is relatively longer and has a more sinuous ventral border, while the rami of the two sides are somewhat less widely separated, converge more gradually forward and meet in a rather longer symphysis. The coronoid process is higher, broader, and more inclined backward, so that the sigmoid notch is not as widely open. The condyle is set upon a similarly elongated neck and is a transverse semicylinder, but the masseteric fossa, which is barely indicated in the modern genus, is quite deep and has a raised anterior border, though the fossa is small and placed high upon the ascending ramus. Doubtless the better development of the masseteric fossa in *Necrolestes* is to be correlated with the stouter zygomatic arch. The angle is decidedly smaller and more hook-shaped and has no tendency whatever to inflection.

The cranial foramina are difficult to make out in such a small skull. Such as are visible, however, are suggestively like those of *Chrysochloris*.

The condylar and carotid foramina are not displayed in any of the specimens. The foramen ovale is very large, more conspicuous than in the modern genus and is more widely separated from the "large opening which includes the sphenoidal fissure, foramen rotundum, and optic foramen," for Dobson's description ('83) seems to apply to *Necrolestes* also. This opening is, however, considerably farther forward than in *Chrysochloris*. The infraorbital foramen is larger and covered by a much heavier bony process than in the latter and the lachrymal foramen is also larger, but occupies a similar position.

That the skull of *Necrolestes* is of the same type as that of *Chrysochloris* will be sufficiently obvious from the foregoing description, and although there are many differences between them, these differences are not greater than may often be found within the limits of a single family. In most respects, as would be anticipated, *Necrolestes* has the more primitive skull, as is especially to be seen in the uninflated squamosals, in the presence of a slight interorbital constriction, and in the undiminished strength of the zygomatic arches and the normal shape of their roots and the retention of the masseteric fossa of the mandible. On the other hand, the remarkable, prolonged and upturned snout would seem to be a specialization in the fossil, though the lateral processes of the premaxillaries and the small median anterior spines arising from the horizontal rami in *Chrysochloris* suggest that in the ancestor of that genus the muzzle may have once been much longer than in its existing representatives. In *Notoryctes* the skull is of a different structural type; the occiput is vertical and flattened; the face is very broad at the orbits, contracting abruptly into the short, blunt muzzle. The auditory bulla is extensively open and is partly made up of the alisphenoid, while the angle of the mandible is very distinctly inflected. In brief, the skull of *Notoryctes* is in all essentials marsupial, while those of *Chrysochloris* and *Necrolestes* are as distinctively insectivorous.

The Vertebral Column. — None of the specimens is sufficiently well preserved to make the vertebral formula apparent, although vertebræ from all the regions of the column are represented, most of them belonging to a single individual. The cervical vertebræ are very much like those of *Chrysochloris;* they have short, broad, depressed centra, without hypapophyses, and very slender neural arches, though some, at least, possess fairly well developed neural spines, while in the modern genus only the axis is so provided. In neither *Chrysochloris* nor *Necrolestes* are the cervicals at all like the curiously reduced and ankylosed neck vertebræ of *Notoryctes*.

The thoracic vertebræ also are like those of *Chrysochloris*, with small, subcylindrical centra, broad, depressed neural arches, and short neural spines, which, as in the African genus, all incline backward, there being no anticlinal vertebra. The spines and metapophyses are, at least in the posterior half of the region, somewhat better developed than in *Chrysochloris*, as is also true of *Notoryctes*, though in the latter the spines are much more slender than in either of the insectivorous genera.

The lumbar vertebræ number at least four and perhaps five. The centra are broad and depressed, and the neural spines are quite elongated and are directed obliquely backward, as in the African form. The spines are somewhat longer than in the latter and have less of a rectangular shape, their free ends being more curved and pointed and less abruptly truncated. The metapophyses also are more prominent, and the transverse processes, though nearly as much reduced in size, are further removed from them, arising from the centra and not from the arches. In *Notoryctes* the lumbars are quite different from those of either of the other genera; the first one is the anticlinal, with an erect spine, while the spines of the others incline forward. The spines also are much smaller and more slender than in the two insectivores; the transverse processes, on the other hand, are much better developed, as are also the metapophyses, and the zygapophyses are of the interlocking cylindrical type. A remnant of the latter structure is observable in *Necrolestes*.

The sacrum is very like that of *Chrysochloris*. Dobson gives the number of sacral vertebræ in the latter as five, but of these only three are true sacrals and are in contact with the ilium. In *Necrolestes* the arrangement is the same except that the two succeeding vertebræ, which in the recent genus are fused with the sacrum, are free and separate. The centra of the sacral vertebræ are broader and heavier than in the African type and the neural spines are even more reduced, not uniting into a continuous ridge. The iliac surface is large. *Notoryctes* has a very peculiar sacrum, quite different from that of the other two genera; it is very long and broad and on each side the transverse processes unite into a bony plate which is connected in front with the ilium and behind with the ischium, while ventral transverse processes (pleurapophyses?) from the last two vertebræ are likewise ankylosed with the ischium. The sacrum thus appears to be covered with a small carapace.

One very marked difference between *Necrolestes* and *Chrysochloris* is in the character of the tail, which in the latter is very short and rudimentary, but in the former was evidently quite long, stout and well developed. The anterior caudal vertebræ, at least, have complete spines, transverse processes, metapophyses and zygapophyses, which in the African genus are either obsolescent or wanting. On the other hand, the processes are not so long and prominent as they are in *Notoryctes*, nor have any vertebræ at all resembling the curious, massive distal caudals of the marsupial been found in connection with the Patagonian fossils.

As a whole, the vertebral column is exceedingly like that of *Chrysochloris*, but slightly less modified. The various processes and spines are not so much reduced and the tail is considerably longer and better developed.

The fore-limb is curiously alike in all three of the genera here discussed, though it would seem that *Necrolestes* had been less completely adapted to a burrowing mode of life than either of the modern genera.

Of the scapula not enough is preserved to display the form, but what remains resembles the corresponding part of *Notoryctes* rather than that of *Chrysochloris*. The postscapular fossa differs from that of the latter in being convex instead of concave, as is also the case in the marsupial, and the neck is much narrower, and, as in the latter, the ridge which runs parallel with the spine near to the glenoid border is very prominently developed, and curving toward the spine almost forms a tube. This ridge is likewise indicated in *Chrysochloris*, but is very inconspicuous. The spine is high and recurved and evidently terminated in a long acromion, but whether the latter attained such exaggerated proportions as in the two existing genera, there are no means of determining. The glenoid cavity is a broad oval and quite deeply concave, and the coracoid is obsolete, as it also is in *Chrysochloris*, while in *Notoryctes* it is quite well developed.

The humerus (Plate LXIV, figs. 4–4^a) is extraordinarily like that of *Chrysochloris*, with only a few minor differences. The head is large, strongly convex and of ovoid shape, with the long axis directed parallel to that of the shaft; it is a little smaller but projects rather more behind the plane of the shaft than in the African genus. The tuberosities are also well developed, but the internal one is not so large as in *Chrysochloris* and the bicipital groove is not so deep, while the shaft is more slender; the crest for the attachment of the pectoralis major muscle is even more prominent and more acutely pointed, and is situated rather more proximally upon the shaft. The supinator ridge is enormously developed in proportion to the size of the bone. The internal epicondyle has almost as extreme a development as in *Chrysochloris*, though the process is somewhat shorter and extends rather less internally and more distally; the foramen is very small. The distal trochlea is broad but very low; the facet for the capitellum of the radius is much broader, but less prominent, and less spheroidal in shape than in the African type. The anconeal fossa is a mere transverse, shallow groove. The humerus of *Notoryctes* closely resembles those of the two insectivorous genera, though differing in some respects from both of them. The deltoid ridge, which is not apparent in the latter, is very prominent and ends in a process for the pectoralis major. The supinator ridge is exceedingly large and the internal epicondyle is very much as in the two Insectivora, but it lacks the foramen, and the shaft is so twisted that the epicondyle has received a more backward direction. The trochlea resembles that of *Necrolestes* in the shape of the facet for the capitellum of the radius.

The forearm bones (Plate LXIV, Fig. 5) of *Necrolestes* are strikingly like those of *Chrysochloris* with differences of only minor importance. The radius has a less discoidal and more broadly oval head, which has a quite deeply concave facet for the median convexity of the humeral trochlea; the shaft is stouter than in the African type and has a more distinctly marked lateral curvature; proximally its position is on the external side of the elbow-joint, but it crosses the ulna, running most of its course in front of the latter, while distally it is internal; the distal end is relatively broad and its anterior face is grooved by shallow sulci for the extensor tendons. The ulna has a remarkably elongate olecranon, which closely resembles that of *Chrysochloris*, but is rather shorter and broader; the process is sickle-shaped and curves toward the internal side of the arm, or mesially, with the external border convex and the inner one concave; this curvature is more pronounced than in *Chrysochloris;* the anterior face of the process is almost plane, but the posterior face is made convex by a prominent median ridge. The sigmoid notch is a short, but deep transverse groove and the coronoid process forms a prominent ridge. The shaft of the ulna is stouter than in the golden moles and the distal end is a bluntly rounded point, with a prominent ridge external and anterior to it. The forearm bones of *Notoryctes* have a curious resemblance to those of the two insectivorous genera; the radius is shorter, but its transversely oval head is more like that of *Necrolestes;* the olecranon of the ulna is much more slender and more decidedly curved than in the fossil, curving more posteriorly and less internally.

As is well known, *Chrysochloris* possesses a third fore-arm bone, which is as long as the radius and which runs from the palmar face of the carpus to the elbow joint, where it has a ligamentous connection with the entepicondyle of the humerus. Flower regards this as apparently "an ossification in one of the flexor tendons" ('85, p. 275). The same structure appears to have been repeated in *Necrolestes*, though only the distal portion of it is ossified.

Of the carpus are preserved in one individual the scaphoid, lunar, trapezoid and magnum, and in connection with the latter the third metacarpal. A second specimen contains the pyramidal and unciform. Though much less reduced and specialized, the resemblance of these carpal bones to those of *Chrysochloris* is unmistakable. The scaphoid is a very large bone proportionately; it is much like that of the African genus, but relatively larger; the radial facet takes up but little of the proximal end of the bone, where it forms a small convex prominence. The palmar side of the scaphoid bears an articular surface, though it is not apparent what purpose this facet may have served. The distal end carries three facets, for the trapezium, trapezoid and magnum respectively, all of which are concave in shape, and that for the trapezium is exceedingly small; the facet for the magnum is small but distinct.

The lunar is much smaller than the scaphoid, though, like the latter, relatively larger than in *Chrysochloris*. It has a broad, convex proximal facet for the radius, which descends well upon the anterior face of the bone. The distal articulation appears to be entirely with the magnum, and if there was any contact with the unciform, it must have been a very limited one.

The pyramidal is likewise proportionately larger than in *Chrysochloris* and covers the whole distal end of the ulna; it is short proximo-distally and rather broad.

The trapezium is not preserved in any of the specimens, but its presence may be inferred from the facet on the scaphoid. The trapezoid is exceedingly small, but may, nevertheless, have supported a well developed digit.

The magnum is considerably larger than the trapezoid and in shape resembles that of *Chrysochloris* more than do the other carpals. Proximally it is covered almost entirely by the lunar, but also sends out a short process to reach the scaphoid. Distally, it supports only the third metacarpal and appears to have no connection with the second. The unciform is relatively very small, especially in the proximo-distal diameter, which gives it a flattened, almost scale-like appearance; evidently, it is beginning to undergo a marked reduction.

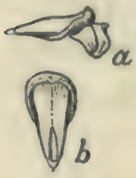
In *Chrysochloris* the carpus has experienced an extraordinary degree of modification and reduction; the central is suppressed, as are also the trapezium and trapezoid, the second metacarpal articulating directly with the scaphoid. There are thus only two bones in the distal row of the carpus, the magnum and the unciform, and of these the unciform is much reduced, as is also the pyramidal.

The number of metacarpals present in *Necrolestes* was probably five, though only two, the third and fourth, are preserved in connection with the carpus. From the size of the trapezium, trapezoid, and unciform it may be inferred that the metacarpals did not differ greatly in size and that there was no such enlargement of mc. III at the expense of the others as has taken place in *Chrysochloris.* The third metacarpal is short and stout, but not nearly so broad as in the African genus, and it entirely lacks the relatively great extension toward the external side which in the latter reaches to the ulna. The proximal end bears a saddle-shaped surface for the magnum and the distal end has a nearly plane, very slightly saddle-shaped facet, which is very oblique to the axis of the shaft, sloping downward and forward. This distal end is very different from that seen in *Chrysochloris*, which is modelled for articulation with the great ungual and looks as if the first phalanx (if not the second also) were ankylosed with it. The fourth metacarpal is but little smaller than III, which it resembles in shape; it articulates with the unciform and is not, as in *Chrysochloris*, received into a depression beneath the great ulnar projection of mc. III.

In *Chrysochloris* the metacarpus is exceedingly peculiar; mc. I is very small and is attached to II; the latter is larger, though very slender, and is carried by the scaphoid; mc. III is relatively very large, while mc. IV is very much smaller and is carried by mc. III, while mc. V is wanting.

The phalanges of *Necrolestes* are present in normal numbers. Those of the proximal row are shortened to an extreme degree and are hardly more than irregular discs of considerable breadth. Those of the second row are minute in size, but are well formed, having a distinctly defined proximal trochlea, and a pulley-like distal trochlea. The ungual phalanges are all of moderate size, that of the third digit not being enlarged into the great trowel-like bone seen in *Chrysochloris*, nor are those of the other digits reduced in anything like the same degree. In shape, these unguals are all of similar type; they are slender, pointed, slightly compressed and decurved, and cleft at the distal end. At the base of the phalanx is a raised rim, like an incipient bony hood, which overhangs and conceals the proximal articular surface. This surface has two distinct pits divided by a median ridge, and is so deep and oblique that the other two phalanges of each digit are concealed from sight, when the manus is viewed from the dorsal side. There is a large flat subungual process.

FIG. 35.

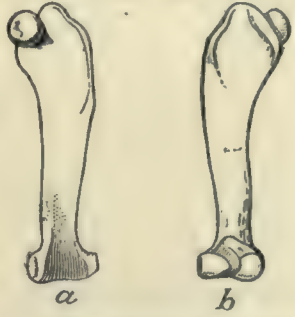


Phalanges of digit III, left manus, of *Necrolestes patagonensis*, × $\frac{2}{1}$. *a*. Phalanges from the outer side. *b*. Ungual, dorsal view.

Incomplete as are these fossils, they suffice to make it clear that the manus of *Necrolestes* is very much less modified than that of *Chrysochloris*, having the normal number of carpals and phalanges, while all of the digits appear to be of approximately equal size. At the same time the highly differentiated manus of *Chrysochloris* might very well have been derived from such a type as that of the Patagonian fossil, and the modifications seen in the latter all tend in the direction of the African genus, as may be observed in the peculiar shape of the magnum, the reduction of the unciform, the suppression of the centrale, and in the shape of the phalanges. The manus of *Notoryctes* bears a superficial resemblance to that of *Chrysochloris*, a resemblance which is given by the great enlargement of the third ungual and still greater size of the fourth, but all the bones of the hand are of a different type and the unguals are not cleft at the tip.

The pelvis differs from that of both the modern genera, though it is most like that of *Chrysochloris*. The ilium is long, slender, rounded, and very slightly expanded at the anterior end. It is more elongate and more expanded anteriorly than in the African form, but otherwise resembles the latter and is quite different from the ilium of *Notoryctes*, in which the anterior expansion is far greater and is coössified with the transverse processes of the sacrum. The ischium is short and without tuberosities; it is deeper vertically than in *Chrysochloris*, though far less so than in *Notoryctes*, in which the bone is of a totally different shape and is ankylosed with the transverse processes of the sacrum. The pubis is long, apparently meeting its fellow of the opposite side in a symphysis (as is not the case in *Chrysochloris*) and the obturator foramen is large. One of the greatest peculiarities of *Chrysochloris* is the reduction of this foramen to two minute perforations, and associated with this is the entire absence of any pubic symphysis, the two pubes being more widely separated than are the two ilia. In *Notoryctes* also, despite the very large size of the ischia, the obturator foramina are very much reduced. In short, both the African and the Australian genus have curiously modified pelves, though modified in entirely different fashion in each case, while the pelvis of *Necrolestes* is of the normal, undifferentiated insectivorous type.

Fig. 36.



Necrolestes patagonensis, left femur, × $\frac{2}{1}$. *a*. Front view. *b*. Hind view.

The femur, as Ameghino has pointed out, is extraordinarily peculiar, though not without a certain resemblance to that of *Chrysochloris*. The head is small, hemispherical and set upon a very short neck, presenting obliquely inward and forward, so that the head is invisible when the bone is viewed from behind; the pit for the round ligament is exceedingly minute. The great trochanter is a thin, compressed ridge, which also presents forward as well as outward, with the digital fossa quite obsolete. The second trochanter is a small, compressed, pyramidal projection, and is connected with the great trochanter by a rough ridge, while the third trochanter is hardly more than indicated. The femoral shaft has its proximal position much twisted; it is broad transversely, and compressed antero-posteriorly, while the distal portion of the shaft is very slender and of cylindrical shape. The distal end is moderately widened and the rotular trochlea is very broad and shallow, almost plane transversely, in fact. The condyles are very small, hardly projecting behind the plane of the shaft, and they are quite widely separated from each other.

In *Chrysochloris* the femur is not altogether dissimilar to that of *Necrolestes*, but differs in many respects. The head is conspicuously larger and presents less forward; the great trochanter is thicker and there is an indication of the digital fossa; the shaft is thicker and the condyles are much larger.

In *Notoryctes* the femur is quite different from that of either of the other genera; the head is large and presents directly inward; the proximal end is much widened by the expansion of the great trochanter, which encloses a broad, shallow fossa on the *anterior* face of the bone, but there is no digital fossa or third trochanter; the femoral shaft is short and straight.

The tibia of *Necrolestes* is slender and elongate, though a little shorter than the femur. The proximal condyles are faintly marked and are separated by a very shallow groove; there is no tibial spine. The anterior border of the proximal end of the tibia is raised into a crest, which makes this end decidedly concave in the antero-posterior direction, but there is no distinct cnemial crest. The shaft is slender and has a lateral sigmoid curvature, while toward the distal end it broadens slightly. The fibula is closely applied to the tibia, but does not coalesce with it at any point; its proximal and distal ends are broad and thick and the shaft is slender, but not filiform.

In *Chrysochloris* the leg bones are coössified; the proximal end of the tibia has not the vertical crest which is characteristic of *Necrolestes*, but possesses a feebly marked cnemial process, which gives to this region of the shaft a more trihedral shape. In *Notoryctes* the leg bones are very peculiar; the tibia has an immense cnemial crest, which runs nearly the whole length of the shaft and to which the relatively enormous patella is attached; the shaft is short and straight, much compressed laterally, but made exceedingly thick antero-posteriorly by the great cnemial process. The fibula is free and is in contact with the tibia only at the two extremities; it also has the proximal end much expanded antero-posteriorly, while the shaft is stout and has a thickened distal end.

Of the pes in *Necrolestes* only the calcaneum, astragalus and cuboid are represented. The calcaneum has a rather short and slender tuber, which is tapered toward the free end and is so curved as to be convex externally and concave internally, thus differing from both of the modern genera, in which the tuber is longer, stouter and quite straight. The astragalus has a neck which is directed strongly toward the mesial side of the foot, ending in a very small rounded head. The cuboid is very small, but of a shape not unlike that seen in *Chrysochloris*, which, however, much exceeds it in every dimension, especially in the proximo-distal length. So much of the tarsus as is preserved displays but little resemblance to that of *Chrysochloris.*

Among the loose bones associated with one of the specimens is one which much resembles the falciform bone which is attached to the tarsus in *Notoryctes*, but its reference is quite uncertain.

Relationships. — The taxonomic position of *Necrolestes* would seem to be reasonably clear. It cannot well have had any direct connection with *Notoryctes*, because the latter is in every essential respect a marsupial, while *Necrolestes* is as distinctively one of the Insectivora. The presence of four upper incisors is no indication of marsupial affinities, since even in the modern *Soricidæ* there are four incisors in the premaxillary. Though there are many resemblances between the South American and the Australian genus, it can hardly be doubted that these resemblances are due to convergence, as are also the many likenesses between *Chrysochloris* and *Notoryctes.* On the other hand, the similarites of *Necrolestes* to *Chrysochloris* seem probably to be due to genetic relationship. This conclusion is justified not only because the resemblances between the two genera are so numerous and so close, but also because even the differences are, for the most part, such as usually occur between the earlier and later members of a phylum or of two allied phyla.

The resemblances are to be found in all parts of the structure. The dentition is of very similar type in the two genera, especially the molars and the posterior premolars. The incisors and canines of *Chrysochloris* are modernized in a way that, as Leche has shown, has been frequently repeated within the limits of the modern insectivorous families. Aside, perhaps, from the relatively large size of the canines, the dentition of *Necrolestes* is one from which that of *Chrysochloris* might readily have been derived. The same is true of the skull; in most respects the skull of the African genus is much the more differentiated of the two. This is especially to be seen in the inflated condition of the temporal region in *Chrysochloris*, but the skull of *Necrolestes* is not far removed from what the ancestral type of the former probably was.

The vertebræ of *Necrolestes* in all regions of the column are remarkably like those of *Chrysochloris* (except that the former had a much better developed tail) differing from them in only a few details, while those of both genera are altogether unlike the characteristic vertebræ of *Notoryctes.*

Imperfect specimens of the scapula resemble *Notoryctes* rather than

Chrysochloris, but the humerus is almost exactly as in the latter, as are also the forearm bones, even to the ossification of the flexor tendon.

The manus is very much less reduced and specialized than in the African genus; the carpals, metacarpals and phalanges are present in nearly or quite their normal numbers and the digits were apparently five and of approximately equal size. The ungual phalanges are all of similar type, that of the third digit not being greatly enlarged, nor the others much reduced. It is evident that *Necrolestes* cannot have been so thoroughly well adapted to burrowing habits as is *Chrysochloris*, though the structure of the arm and forearm shows that it was fossorial. Different as the manus is in the two genera, the plan of structure is the same in both and that of *Chrysochloris* may well have been derived from a type like that of *Necrolestes*.

The pelvis of the Patagonian genus is not altogether unlike that of the African, but it is much less modified, as is to be seen in the large size of the pubes and of the obturator foramina. The hind leg and foot are, however, quite peculiar and appear to have been specialized in a manner different from that characterizing any of the modern families of Insectivora.

Another consideration which renders it probable that *Necrolestes* itself, or its immediate ancestor, was an immigrant from Africa, is the entirely isolated position of this genus in the Santa Cruz fauna. Of course, it might have been the last remnant of a once numerous group, but no allies, or near relations, or probable ancestors have been found in any of the pre-Santa Cruzian formations. Had the family been a truly indigenous one, we should undoubtedly find a greater or less number of allied genera, as is the case with all the other orders represented in the Santa Cruz beds, but *Necrolestes* stands quite alone, a fact which is explicable only on the assumption that it is an immigrant.

It is not suggested that *Necrolestes* is to be regarded as the ancestor of any of the existing *Chrysochloridæ*, for it is itself specialized in a different, though moderate way. What does seem probable is that *Necrolestes* is an offshoot from some early member of the family which was at the same time the ancestor of *Chrysochloris*. If this conclusion is correct, it will lead to the further inference that the family originated in the Southern Hemisphere, and will militate against the view that the Cape golden moles are allied to the true moles. The resemblances, neither many nor close, between the two families are much more probably the results of adaptation to similar habits of life than to genetic relationship. The more the Santa Cruzian fauna is studied, the more clearly does it appear that these southern mammals are but very remotely connected with their analogues of the Northern Hemisphere. Rütimeyer's suggestion of a southern centre of origin and distribution becomes, with advancing knowledge, distinctly more probable than the view which regards all southern types as having migrated from the great northern centres of development.

Another important corollary of the reference of *Necrolestes* to the *Chrysochloridæ* is that it makes necessary, or at least probable, the assumption of a land connection between Africa and South America. There is no reason to suppose that the track of migration could have been by way of Europe and North America, for no trace of this family has ever been found in any of the northern continents. This supposed connection of Africa with South America has often been suggested before and is supported by many independent lines of evidence. Into the discussion of this evidence it is not necessary to enter here, for it has lately been summed up by Lydekker ('96, 127, 255) and Tullberg ('99, 491) and must again be considered in the general statements concerning the Santa Cruz fauna as a whole. It may be pointed out, however, that the presence of *Necrolestes* in Patagonia is, so far as it goes, distinctly confirmatory of the hypothesis.

NECROLESTES PATAGONENSIS Ameghino.

(Plate LXIV, figs. 1–5.)

Necrolestes patagonensis Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 303.

Though I have referred all the specimens in the collection to this species, it is not altogether improbable that more than one species is represented among them. The type of *N. patagonensis* is a left mandibular ramus, lacking the coronoid and symphysial region. As already mentioned, this individual is remarkable for the great size of the canine root, which is plainly divided into two, and rises so high above the alveolus as to raise the base of the crown above the tops of the grinding teeth. In the Princeton specimens the enamel-covered crown of the tooth descends into the alveolus, the root is much smaller, though there is some individual variation in this respect, and I cannot detect any division of it. If the peculiarities of the type are normal and not pathological, it will probably prove to be specifically distinct from the Princeton specimens.

Among the latter we find some indication of two types of skull, as was pointed out in the generic description. In one (Pl. LXIV, fig. 1) the skull is narrow and the snout is upcurved in a most curious fashion, being continued well in advance of the incisors and making the upper contour of the face strongly concave. The other skull (fig. 2) is broader, heavier, with nearly straight facial contours and, apparently, no great prolongation of the snout. The difficulty of determining whether these skulls are really as different as, at first sight, they seem to be, lies in the fact that the first has suffered hardly any distortion, while the second has been crushed vertically and the tip of the snout is somewhat broken.

All the individuals agree well in size and indicate an animal of about the same size as *Chrysochloris villosa.*

MEASUREMENTS.

	No. 15,065.	*No. 15,384.*	*No. 15,699.*
Upper dentition, length	.018		.017
" " " of incisor series	.0035		.004
" " " canine to $m^{\underline{3}}$	.0125		.011
" " " of premolar series	.0055		.0055
" " " of molar series	.0035		.003
Upper canine, antero-posterior diameter at base	.0025		.002
" " transverse "	.0015		
Lower dentition, length of incisor series			.003
" " " canine to $m_{\overline{3}}$	.014	.0125	
" " " of premolar series	.0055	.0053	.0055
" " " of molar series	.004	.0033	
Lower canine, antero-posterior diameter	.002	.002	.002
" " transverse "	.0015	.001	
Occiput, width at base	.020	.020	
Skull, length to $i^{\underline{1}}$	.035		
" interorbital width	.012		
" length, orbit to end of rostrum.			
" " " " $i^{\underline{1}}$	.016		
Zygomatic arch, length	.0125		
Palate, length	.016		
" width outside of $p^{\underline{2}}$	.011		
" " " " $m^{\underline{2}}$	.012		
Mandible, length from condyle to canine	.024	.0225	
" " " angle to canine	.0205	.0195	
" depth at $p_{\overline{4}}$	.0035	.003	
Last seven trunk vertebræ, length		.028	

	No. 15,384.	*No. 15,699.*
Penultimate lumbar, length	.004	
“ “ width of anterior face	.003	
“ “ height to end of neural spine	.007	
Sacrum, length	.009	
Pelvis, length	.024	
Ilium, length	.016	
“ greatest width	.0045	
Humerus, length	.016	
“ proximal width	.0055	
“ distal width over epicondyles	.010	
“ width of trochlea	.006	
Radius, length	.014	.0155
“ proximal width	.003	.0035
“ distal width	.003	.0033
Ulna, length	.023	
“ width at sigmoid notch	.0035	
“ distal width	.002	.002
Metacarpal III, length	.003	
“ “ proximal width	.0026	
“ “ distal width	.0023	
Digit III, ungual, length		.0065
“ “ “ proximal width		.0026
Digit IV, phalanx 1, length		.0005
“ “ “ “ proximal width		.002
“ “ “ 2, length		.0025
“ “ ungual, length		.0055
“ “ “ proximal width		.003
Femur, length from head		.018
“ “ “ great trochanter		.018
“ proximal width		.005
“ distal width		.004
Tibia, length		.017
“ proximal width		.0045
“ distal width		.002
Fibula, length		.015
“ distal width		.0015
Calcaneum, length		.0043
Astragalus, length		.003
“ width of trochlea		.0025

PART III. GLIRES.

The rodent fauna of the Santa Cruz beds consists exclusively of Hystricomorpha, a very marked contrast to the modern fauna of the same region, in which the Myomorpha predominate. All of the non-hystricomorph rodents which now inhabit South America are of northern origin, their ancestors having reached South America not earlier than the close of the Miocene, when the great intermigration of the mammals of the two continents began.

Confining our attention to the Hystricomorpha, we find that the Santa Cruz rodents are very closely allied to recent South American genera and are all referable to existing families and even, with one exception, to existing subfamilies. The richness and variety of this assemblage are surprising, for, except the *Dasyproctidæ* and *Dinomyidæ*, all the recent families are represented and the number of genera is comparable to that which is spread over the entire Neotropical region of to-day. It must not be supposed that the full number of Santa Cruz genera has been already discovered, though it is improbable that the list will be very greatly extended in the future; for, from the large collections made by Messrs. Hatcher & Peterson for Princeton University and by Mr. Brown for the American Museum of Natural History, not a single new genus has been added to those described by Ameghino, and even of new species the number is very small.

The general aspect of the Santa Cruz rodents is strikingly modern and a hasty examination might easily lead to the conclusion that they were essentially the same as the recent forms, but such a conclusion would be quite erroneous. The genera are all extinct and a considerable number of them have left no successors; these latter are, for the most part, the more or less modified survivors of earlier faunas and, for that reason, are often of great phylogenetic importance.

The subjoined table, which follows Thomas' arrangement of families and subfamilies ('96, 1015 ff.), will serve to give an idea of the comparative number of the hystricomorph rodents of South America in Santa Cruz and in recent times.

Recent.		*Santa Cruz.*
	I. OCTODONTIDÆ.	
	1. *Octodontinæ.*	
Ctenomys.		
Aconaemys.		Not found.
Spalacopus.		
Octodon.		
Abrocoma.		
	2. *Loncherinæ.*	
Dactylomys.		
Thrinacodus.		Stichomys.
Kannabateomys.		Adelphomys.
Loncheres.		Gyrignophus.
Thricomys.		Spaniomys.
Cercomys.		Graphimys.
Carterodon.		
Mesomys.		
Echimys.		
	3. *Capromyinæ.*	
		Neoreomys.
Myocastor.		Scleromys.
Capromys.		Lomomys.
Plagiodontia.		Olenopsis.
	II. ERETHIZONTIDÆ.	
	1. *Erethizontinæ.*	
Coendou.		Steiromys.
	2. *Chætomyinæ.*	
Chætomys.		Not found.
	3. *Acaremyinæ.*	
		Acaremys.
Wanting.		Sciamys.
	III. CHINCHILLIDÆ.	
Viscaccia.		Prolagostomus.
Chinchilla.		Pliolagostomus.

Recent.		*Santa Cruz.*
Lagidium.		Scotæumys.
		Perimys.
		Sphodromys.
	IV. Dasyproctidæ.	
Dasyprocta.		Not found.
Agouti.		
	V. Dinomyidæ.	
Dinomys.		Not found.
	VI. Caviidæ.	
Cavia.		Eocardia.
Kerodon.		Schistomys.
Dolichotis.		Phanomys.
Hydrochœrus.		
29		20

The Santa Cruz rodents are, of course, somewhat more primitive in structure than their recent successors, but the difference is hardly so great as might have been expected. In most instances, the teeth have a somewhat simpler pattern, but in others the modern pattern is fully attained and in a few cases surpassed. The skull structure is very nearly the same in the two faunas, with very minor differences. For example, the palate is rarely so extremely triangular as in many of the modern genera; the coronoid process of the mandible is less reduced in size and the masseteric crest is more normal in development. Limbs and feet are usually, but not always, relatively smaller and the ulna and fibula have undergone little reduction. The number of digits is known in only a few of the Santa Cruz genera and in most of these the formula is V–V, but in the cavies the number IV–III is already characteristic.

From a phylogenetic point of view the Santa Cruz rodents are of much interest. In several of the genera, there is every reason to believe, we have the direct ancestors of existing forms: for example, *Viscaccia* was probably derived from *Prolagostomus, Dolichotis* from *Schistomys, Erethizon* and *Coendou* from *Steiromys*. Several other genera may also be regarded as probable ancestors of recent types, but are still too incompletely known for any definite determination of their relationships. Thus, *Scotæumys* is the probable forerunner of *Chinchilla* and *Lagidium*, and the modern

Loncherinæ have no doubt descended from those of Santa Cruz times, but the latter are not yet sufficiently well known for us to distinguish the ancestral from the collateral forms. It is surprising that *Ctenomys*, now one of the most abundant and characteristic of Patagonian rodents, should have no Santa Cruz representative.

Another group of Santa Cruz genera comprises certain specialized types which did not persist to a later epoch. Prominent among these are *Acaremys* and *Sciamys*, which Ameghino has very properly grouped together as a subfamily of the *Erethizontidæ*. The numerous species of these two genera are all very small and some of them minute, superficially like the rats and mice whose place they filled in Santa Cruz times, when South America possessed no representatives of the Myomorpha. In these animals the molar pattern is like that of the tree-porcupines, but the skull, limbs and feet are quite different and indicate that their habits were probably terrestrial.

Still a third category of genera, already alluded to, includes those rodents which, though not ancestral to any of the existing types, are yet phylogenetically important, because they have preserved, with more or less modification, the ancestral forms of an earlier epoch. *Neoreomys* is an example of this; on the whole, it resembles *Myocastor* and *Capromys* more than any other recent genera and is therefore included in the same subfamily, but the likenesses to the *Dasyproctidæ* and *Dinomyidæ* are also very suggestive and indicate that this genus is not far removed in structure from some earlier and more generalized form, which was the common ancestral stock of several distinct families. Another instance of the same kind is afforded by *Perimys*, the Santa Cruz species of which are not ancestral to any modern rodent, or to any yet known from intermediate formations, but they probably differ little from some earlier genus that formed the common stock whence all the *Chinchillidæ* were derived.

Although most and probably all of the existing South American families of Hystricomorpha had already become distinctly separated as such, and even the subfamilies are more or less clearly defined, yet the separation is not so great as between the existing representatives of the same groups. There is more uniformity in dental pattern and in the structure of the skull and skeleton than we find at present, and the various families are evidently converging backward in time to a common ancestry. This is strong evidence for the unity of origin of all the Hystricomorpha, or, at least, of all the South American families of the suborder. It will, I think, be eventually possible to prove that all the varied molar patterns of the existing genera have been derived, now by simplification, again by increased complication, from a pattern which is nearly exemplified by the genera *Luanthus* and *Cephalomys* of the Patagonian beds.

This conclusion agrees in a general way with the results of Winge ('87, 128) who assumes that the grinding teeth were early complicated by the formation of four more or less complete, transverse folds, though I should regard three as the more probable number of such folds.

Tullberg, on the other hand, does not accept this conclusion: "Mehrere Gründe lassen es meines Erachtens einfacher erscheinen, für die Backzähne der *Hystricomorphen* eine allmähliche und bei den verschiedenen Formen selbständig je nach Bedarf eintretende Komplizierung auzunehmen. Es ist natürlicherweise nicht unmöglich, dass Falten bei dieser oder jener Form, welche deren mehrere an jedem Zahn besass, reduziert worden sind. Daraus dürfte indes keineswegs zu folgern sein, dass die ursprünglichen *Hystricomorphi* ebenso zahlreiche Falten gehabt hätten, wie Z. B. die *Erethizontiden*. Falls man dieses behauptete, müsste man nämlich annehmen, dass die Falten bei *Cavia* und *Dolichotis* reduziert, aber bei *Hydrochœrus* an Zahl vermehrt, bei *Petromys* und *Aulacodus* und dieses ebenfalls bei allen *Echinomyiden*, *Myopotamus* ausgenommen, reduziert worden wären" ('99, 365).

So far as the cavies are concerned, the assumption which Tullberg regards as so improbable is demonstrably true. It will be shown in a subsequent chapter that in *Schistomys*, which is almost certainly the direct ancestor of *Dolichotis*, the unworn teeth have three transverse enamel folds, in addition to the principal valley between the prisms. These folds are soon converted by abrasion into enamel lakes and in the fully adult animal they are entirely worn away, leaving the teeth exactly like those of *Dolichotis*. In *Luanthus*, of the pre-Santacruzian, or Patagonian beds, the pattern of the teeth is the same as in *Schistomys*, with the important exception that the enamel folds are deeper and the teeth are rooted. Here, then, we have clear evidence that in *Dolichotis*, at least, the existing type of tooth has been acquired by simplification.

The Santa Cruz rodent fauna throws no light whatever upon the problem concerning the relationships of the Hystricomorpha to the other rodent suborders. For this purpose the fauna is of much too late a period to be available, and only the fuller knowledge of the pre-Santacruzian rodents can lead to definite results.

HYSTRICOMORPHA.

OCTODONTIDÆ.

CAPROMYINÆ.

NEOREOMYS Ameghino.

(Plates LXIV, Figs. 6–6^e; LXV, Figs. 1–11; LXX.)

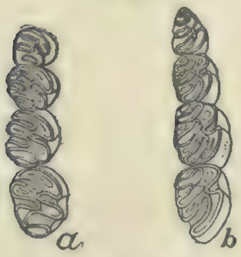
Neoreomys Amegh.; Enumeracion systematica, etc.; 1887, p. 10.
Pseudoneoreomys Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.

This genus includes the most abundant of the Santa Cruz rodents, and its species are among the largest in size. The teeth are quite similar to those of the recent *Myocastor* (*Myopotamus*) though somewhat simpler in pattern and without cement in the valleys. On the other hand, the skull is much more like that of *Capromys*, with certain distinct resemblances to that of *Agouti* (*Cœlogenys*).

Dentition. — The incisors are broad and heavy, with nearly plane or very slightly convex anterior faces and sometimes with a very faintly marked groove near the external border; they differ in proportions from those of *Myocastor*. The grinding teeth vary greatly in appearance according to age and amount of wear. The single premolar in each jaw is erupted very late, not until the last molar is in use. In the unworn state p^4 (Plate LXV, fig. 1) is divided into three laminæ by oblique furrows, which are directed inward and backward across the masticating surface; at the end of the anterior valley, near the antero-external angle of the crown, is an isolated enamel pillar. In the moderately worn state of this tooth the crown is columnar, undivided by sulci, with oblique enamel lakes, indicating the course of the original enamel folds or valleys, of which the posterior is the smallest. Ameghino has distinguished two genera in accordance with the number of these lakes, *Pseudoneoreomys* with three, and *Neoreomys* with a fourth, produced by an internal fold. Probably this difference is merely a matter of abrasion and is determined by the mode in which the original three folds are subdivided by wear.

The upper molars are somewhat more complex; in unworn teeth the crown is similarly composed of three oblique laminæ, of which the median one is the longest and the posterior the shortest, and the latter is subdivided into two parts by a shallow, transverse groove; of these two parts, the inner one has a pocket-like depression of enamel on the posterior side. In the condition of wear which characterizes the adult animal, and which most specimens display, the crown of an upper molar is divided by a deep internal fold into two triangular prisms, of which the anterior one is considerably the larger; the outer end of the foremost valley soon becomes isolated as an enamel lake, while the outer end of the posterior valley is also separated from the inner end and remains for some time as an external enamel fold, but in the fully adult animal it is separated from the outer wall of the crown. The tooth then has a deep internal fold and three enamel lakes. Of these the anterior one is originally a part of the deep inner fold, which has an oblique course, but its outer portion is soon separated to form a lake. A fourth very minute lake is formed by the isolation of the enamel pocket, mentioned above as impressing the posterior side of the hindmost lamina. This minute lake disappears at quite an early stage, so that many teeth show no trace of it. Aged animals, in which the teeth are much worn, lose even the inner fold, which is first converted into a lake and then obliterated.

FIG. 37.

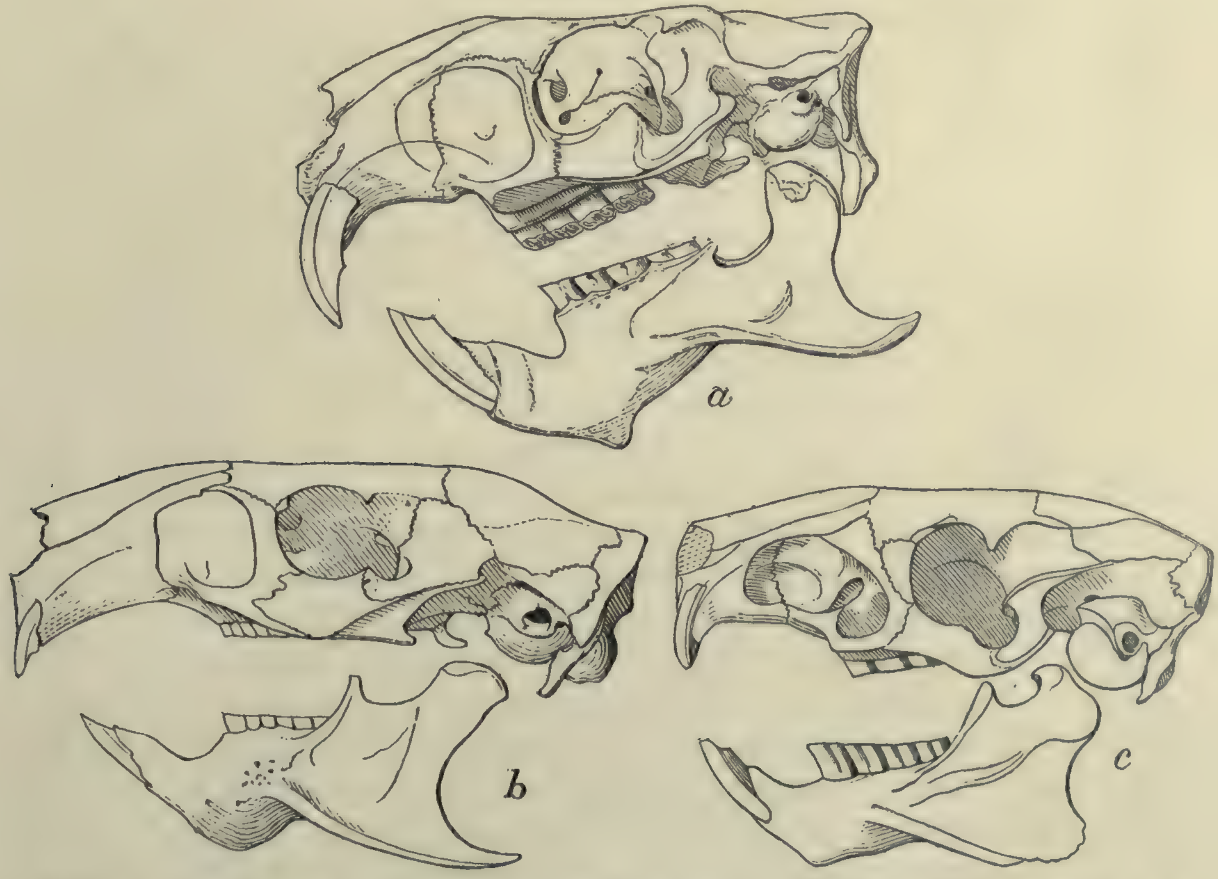


Grinding teeth of *Myocastor coypus*, crown view, ×$\frac{1}{1}$. *a*. Right upper teeth. *b*. Right lower teeth.

In the lower jaw the grinding teeth have a similar character, but are reversed, the deep fold which divides the crown into two prisms being external, and the posterior one of the three lakes is an isolated portion of this fold. All the folds are somewhat shallower than in the upper teeth and hence are sooner cut off from the peripheral wall by abrasion. All of the grinding teeth diminish in diameter toward the base, so that their size is reduced by wear; especially is this true of $m_{\overline{1}}$, which is the first of the permanent lower teeth to be erupted and in an advanced state of wear appears to be quite disproportionately small.

Milk Dentition.—I have seen no example of the temporary incisors, which are probably shed very early. On the other hand, the milk premolar is frequently found, but in most cases is so much worn that its pattern is not clearly displayed. Plate LXV, fig. 3, shows an isolated tooth which I regard as dp^4 of this genus, although it is considerably larger than in most individuals ; its relatively large size is due to the small degree of abrasion which it has suffered, for it contracts much toward the base, especially in the antero-posterior diameter. Dp_4 I have not found in so early a stage and the youngest example is that shown in Plate LXV, fig. 6 ; the tooth is still very large, but already has well developed roots ; the grinding surface displays one wide and deep external fold and two narrower and shallower internal folds ; in addition to these, the anterior prism has two enamel lakes, of which the antero-external is larger and crescentic in shape, and the postero-internal is very minute.

FIG. 38.



Skulls of Octodontidæ, side view. *a. Myocastor coypus*, × $\frac{2}{3}$. *b. Capromys fournieri*, × $\frac{1}{1}$. *c. Neoreomys australis*, × $\frac{2}{3}$.

As a whole, the dentition resembles that of *Myocastor*, though the molar pattern is distinctly less complex ; that of *Capromys* is nearly as simple as in the fossil, and the teeth of *Agouti*, especially the lower molars, might readily be derived from the *Neoreomys* type.

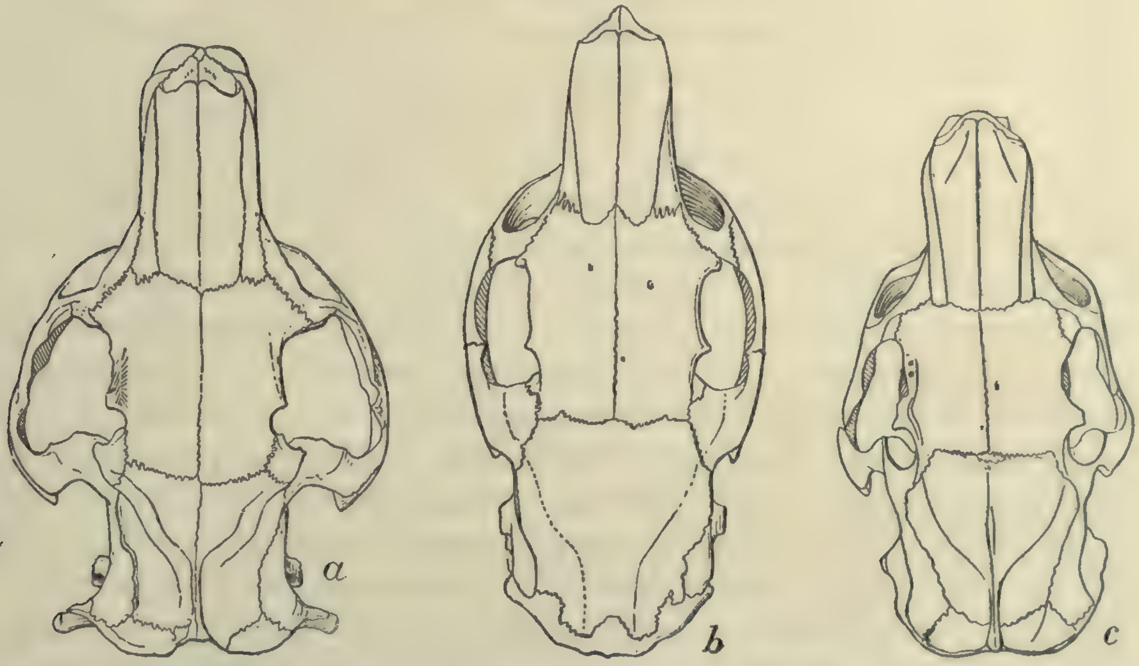
Skull (Plate LXIV, fig. 6). The skull is more like that of *Capromys* than that of *Myocastor*, though with many resemblances to that of *Dasyprocta*. In general proportions and appearance, this skull might be described as intermediate between *Capromys* and *Dasyprocta*; the peculiarities of the *Myocastor* skull are not foreshadowed in *Neoreomys*. As a whole, the skull is long and narrow, much as in *Capromys*; compared with that of *Dasyprocta*, the cranium is relatively longer, the orbit conspicuously smaller, and the rostrum shorter, lower and less tapering. The proportionate lengths of the parietal and frontal zones are much as in *Capromys*, but there is a short and well defined sagittal crest on the hinder half of the parietals.

The occiput (Plate LXIV, fig. 6^c) is not unlike that of *Myocastor*, aside from the altogether exceptional character of the paroccipital and mastoid processes in the latter; it is low and wide, slightly concave and with distinct median ridge; the foramen magnum is high and narrow, as in *Myocastor*, differing from *Capromys* and *Dasyprocta*, in which the principal diameter is transverse; the paroccipital processes have about the same relative development as in the last-named genus, but are more closely applied to the large tympanic bullæ. The supraoccipital is extended much farther upon the roof of the cranium than in *Myocastor* or *Capromys* and differs notably from these genera in having no lateral processes, and not extending down over the periotic, from which it is separated by the supramastoid process of the squamosal. The tympanic and periotic are not unlike those of *Dasyprocta*, but have a still closer resemblance to those of *Cavia*; the periotic is quite extensively exposed on the side of the cranium, but the ascending process is narrower and the mastoid process is hardly more distinct than in the latter genus. The tympanic is inflated into a large bulla and coössified with the periotic; the auditory meatus is a short, incomplete tube, with ventral slit opening into the central hole in the outer wall of the bulla almost exactly as in *Dolichotis*.

The squamosal differs in several particulars from that of *Myocastor*; anteriorly, it does not extend so far along the frontals, being more as in *Capromys* in this respect, while the supramastoid process is considerably broader than in either of the genera named. The zygomatic process most resembles that of *Myocastor*, but extends less outward and more downward; the two glenoid cavities are almost parallel, converging forward but slightly. The jugal is quite similar in shape to that of *Myocastor*, but is much narrower; anteriorly, it ends in a concave suture for the zygomatic process of the maxillary, and does not ascend upon that process. A marked difference from the last-named genus and *Capromys* is furnished by the lachrymal, which is quite large and forms most of the anterior border of the orbit, while in the two modern genera this bone is reduced to rudimentary proportions.

The frontals are rather short, quite broad, and nearly plane, showing no external indications of sinuses; no well defined temporal ridges are present, but the postorbital processes are quite prominent and in front of each process the projecting supraorbital border is notched. The nasals are of nearly the same relative length as in *Capromys*, but are less convex transversely; they are broad, widening somewhat forward; the anterior end of each nasal has a broad, shallow, lateral notch, much as in *Myocastor*, while the hinder ends together form a single convex curve, which fits into a concavity of the frontals. The anterior nares are not unlike

FIG. 39.



Skulls of Octodontidæ, top view. *a. Myocastor coypus*, × $\frac{2}{3}$. *b. Capromys fournieri*, × $\frac{1}{1}$. *c. Neoreomys australis*, × $\frac{2}{3}$.

those of the last named genus in shape, but are lower and wider. The premaxillaries are shorter than in *Myocastor* or *Capromys* and their ventral edentulous surface is broader; the long, narrow, incisive foramina are more as in the latter genus; the frontal processes are longer and narrower than in either.

The maxillaries are lower vertically than in *Myocastor*, in correlation with the less completely hypsodont teeth; the infraorbital foramen is lower and wider, and of quite a different shape, and has no groove for the nerve; the preorbital fossa is much more deeply impressed, as in *Dasyprocta*, another resemblance to which is the large size of the lachrymo-nasal opening. The bony palate is considerably wider than in *Myocastor*, especially at the anterior end, the two series of upper teeth converging less forward. The palatines are longer, extending forward to the middle of m^1, and the posterior palatine foramina notch the palatines more deeply, so as to be almost entirely enclosed in them. The posterior nares are narrower and more elongate than in *Myocastor*, extending almost to the middle of m^2, with a short, sharp, median spine on the anterior border. The pterygoids are not well preserved in any of the specimens, but apparently the fossa did not communicate with the orbit; it is, however, connected with the posterior nares by a round aperture, bounded ventrally by an extension of the pterygoid, which joins the bulla, somewhat as in *Dasyprocta*.

The mandible is very different from that of *Myocastor* and might be described as intermediate in character between that of *Capromys* and that of *Dasyprocta*. The horizontal ramus is short and heavy; the masseteric ridge is quite well developed, but is less prominent than in *Myocastor* or *Capromys;* on the other hand, the pterygoid ridge is much more prominent than in *Dasyprocta*, making the ventral border of the angle much wider; in none of the specimens is the angular process complete, but it would appear to have been shorter than in any of the three recent genera named. The coronoid process, which in *Myocastor* has almost disappeared, is much higher than in the other two genera mentioned, rising as high as the condyle, from which it is separated by a deep and narrow sigmoid notch; the process is also quite broad, especially at the free end; at the base of the coronoid is a small, but well defined, masseteric fossa; the condyle is large and convex, in shape quite like that of *Myocastor*, but a resemblance to *Dasyprocta* may be seen in the thin, plate-like extension behind the condyle, though this extension is considerably shorter and has a more steeply inclined dorsal border than in the modern genus. The inferior dental foramen has the same position as in *Myocastor*.

Vetebral Column and Ribs (Plate LXX). — Except for the cervical and some of the lumbar vertebræ, the backbone is represented by very unsatisfactory material and the vertebral formula is largely conjectural. The neck is short, but relatively stout, its proportions being not unlike those of the neck in *Agouti*. The atlas most resembles that of *Capromys*; it is short, broad and depressed, with low and wide neural canal; the neural spine is a prominent tubercle and there is a distinct hypapophysis; the transverse processes are very different from those of *Myocastor*, resembling rather those of *Agouti*, except that they are considerably shorter. The axis has a neural spine which is quite like that seen in *Capromys* and *Myocastor*, but it is produced more obliquely upward and less backward; the centrum, which is keeled ventrally, is very broad and depressed anteriorly, becoming much narrower behind the transverse processes, which are short and slender. The remaining cervicals are not especially characteristic; they have short and depressed centra, with very oblique faces, and short neural spines, of about the same relative size as in *Agouti;* the transverse processes, on the other hand, are much smaller and the "inferior lamella" is distinct only on the sixth.

The number of trunk vertebræ is very uncertain, but there is reason to believe that the formula is not far from Th. 13, L. 6. In the anterior thoracic region the vertebræ are small, with slender neural spines inclined strongly backward; the spine of the second thoracic appears to have been considerably stouter than that of the first or the third, but not to any such disproportionate extent as in *Myocastor*. Posteriorly the vertebræ become much larger, gradually assuming the character of the lumbars. In the latter, the centra are long and heavy, with ventral keels and expanded, depressed faces, and have long, broad and laterally compressed neural spines, much resembling those of *Agouti* in shape and, as in that genus, strongly inclined forward; the prezygapophyses are very prominent, but the metapophyses are small and do not rise conspicuously above them; the anapophyses are likewise small, a striking contrast to *Myocastor*, in which these processes are remarkably long and prominent. The transverse processes are not complete in any of specimens and their length cannot be determined, but so far as they are preserved, they resemble those of *Agouti;* in fact the lumbars are decidedly more similar to those of the latter than to those of *Myocastor*.

Only fragments of the sacrum have been recovered, enough, however, to show that the spines were long and separate, not fused into a continuous ridge. Nothing is known of the caudal vertebræ, but the fragments of the sacrum indicate that the tail was probably long and well developed.

The ribs likewise are represented by more or less fragmentary remains, which appear to be shorter, more slender and less curved than in *Myocastor*, and to have rather more resemblance to those of *Agouti;* the anterior ribs are broader and more compressed laterally, the posterior ones more slender and rod-like. The sternum is entirely unknown.

Appendicular Skeleton.—The scapula is high and rather narrow, with slender neck and no coraco-scapular notch; the spine appears to be nearly in the middle and to divide the blade into almost equal pre- and post-scapular fossæ, the former perhaps somewhat broader. (In the restoration, Plate LXX, the scapula is incorrectly restored, the prescapular fossa being made too narrow and the coracoid border forming too definite an angle with the suprascapular. Probably the shape was more like that seen in *Agouti.*) A very marked difference from *Myocastor* and *Capromys* consists in the shallowness of the notch, "incisura colli," which determines the length of the acromion; in the two recent genera this notch is extremely deep, while in the fossil it is much shallower, as is clear, despite the fact that in none of the specimens is the acromion preserved, for the distal extension of the spine is shown. The coracoid, though hardly visible from the side, is yet quite large, forming a slender, incurved hook.

In the humerus also we find greater resemblance to *Agouti* than to *Myocastor;* the shaft is relatively long and, for most of its length, is strongly compressed laterally; its thickness, which is considerable in the proximal portion, diminishes distally; the deltoid hook, so conspicuous in *Myocastor* and *Capromys*, is entirely absent; the trochlea is broad and, anteriorly at least, is covered entirely by the radius and consists of three parts, a narrower external and broader internal concavity and a pronounced convexity between them; there is, however, no interruption of the articular surface. The supratrochlear fossa is large and deep and is perforated by a fontanelle, while the anconeal fossa is smaller; the epicondyles are very inconspicuous and there is no entepicondylar foramen.

The fore-arm bones are of moderate length, the ulna about equalling the humerus in this respect, and they are thus somewhat shorter than in *Myocastor*. The radius has a broadly expanded head, which occupies the whole width of the humeral trochlea; the shaft is quite stout, antero-posteriorly compressed and of transversely oval cross-section, and has a decided forward curvature. The ulna has a relatively short olecranon, much as in *Capromys*, a very broad coronoid process and a wide sigmoid notch, which articulates with the posterior side of the humeral trochlea; the shaft is quite stout, laterally compressed and arched forward, with an obscure channel on the outer side of the proximal portion.

Nothing is known of the carpus and very little of the metacarpals and phalanges, which are represented by very fragmentary material. It is apparent, however, that the manus is somewhat larger and heavier in proportion to the pes than is the case in *Myocastor*. A single imperfect ungual phalanx resembles that of *Agouti*, being more depressed and less pointed than in the former, and, seemingly, having no cleft at the tip.

The pelvis is elongate; the ilium has a broad and ill-defined peduncle, which expands quite abruptly into the anterior plate; this anterior expansion is quite unlike the trihedral ilium of *Myocastor*, having somewhat more the shape seen in *Capromys*, but is considerably broader than in the latter; a resemblance to *Agouti* is in the prominent development of the ilio-pectineal process, as also in the division of the gluteal surface by a distinct longitudinal crest. The ischium is incomplete in all of the specimens; so far as preserved, its post-acetabular portion is quite slender and laterally compressed, slightly increasing posteriorly in the dorso-ventral diameter; the obturator foramen is evidently large.

The femur is large, much surpassing the humerus both in length and thickness; the head is rather small and set upon a constricted neck, and the great trochanter is thick and heavy, but rather short, making the notch between itself and the head no deeper than in *Capromys;* the digital fossa is large and very deep; the second trochanter is much reduced and there is no trace of the third. The shaft is stout and somewhat compressed laterally; the distal end is heavy, though the condyles are not prominent; the rotular groove is narrow, but has elevated borders and is continued very far dorsally, resembling that of *Agouti*. The patella is quite large, especially in width, but antero-posteriorly compressed and with a small diameter in that direction; it thus differs much from the massive patella of *Agouti* and is more like that of *Capromys*.

The tibia is not ankylosed with the fibula and is a very heavy bone, of almost the same length as the femur; proximally, the shaft is trihedral, becoming transversely oval distally; the cnemial crest is not very prominent, but extends very far down the shaft, which is much straighter than in *Myocastor*. The distal end is not much broadened, but is quite thick and heavy, and the distal fibular facet is extremely small; the astragalar surface is deeply grooved and asymmetrical, the outer concavity much exceeding the inner in size; on the posterior side is a very long and prominent intercondylar tongue.

Little of the pes is preserved, but apparently it was relatively somewhat less heavy and elongate than in *Myocastor*. The astragalus has a well grooved, asymmetrical trochlea, the outer condyle much exceeding the inner in size; the neck is quite narrow and depressed, ending in a convex head, upon the tibial side of which the navicular facet is reflected; the external calcaneal facet is very large, deeply concave and so oblique as to reduce the fibular surface to a narrow band; this external calcaneal facet is quite widely separated from the narrow sustentacular facet.

The calcaneum is incompletely known, the tuber not being preserved in any of the specimens, but it evidently had a large dorso-plantar diameter and was laterally compressed; the external astragalar facet is large and convex and the prominent, heavy sustentaculum bears a small subcircular facet. The distal portion of the calcaneum is elongate and ends in a very oblique concave surface for the cuboid.

Fragments of the metatarsals indicate that those bones were shorter and heavier than in *Myocastor*.

Restoration (Plate LXX). — Among modern genera it is the skeleton of *Myocastor* which displays the greatest resemblance to that of *Neoreomys*, but there are many differences. In the fossil, the head is smaller and lighter, while the shorter incisor teeth, paroccipital processes and angular processes of the mandible give to the skull quite a different appearance. The neck is more elongated and slender, but the vertebræ of the trunk are quite similar; the long tail, shown in the figure, is entirely conjectural and may perhaps be incorrect. The limbs are somewhat longer tandheir proportions, as well as those of the feet, are rather more like those seen in *Agouti* than those of *Myocastor*.

Relationships. — It does not seem at all probable that *Neoreomys* was directly ancestral to any existing genus. While it resembles the *Capromyinæ* in dentition and skull structure rather more than any other recent rodents, it has also many likenesses to *Agouti*, *Dasyprocta* and *Dinomys*.

It is exceedingly difficult, if not quite impracticable, to determine which of these similarities are due to genetic relationship and which of them to convergent development. On the whole, it seems probable that in *Neoreomys* we have the somewhat modified remnant of a more ancient group, which was the common ancestor of the three families indicated.

NEOREOMYS AUSTRALIS Ameghino.

(Plates LXIV, figs. 6–6^b; LXV, 1–11; LXX.)

Neoreomys australis Amegh.; Enumeracion sistemat., etc., 1887, p. 11.
Neoreomys indivisus Amegh.; Ibid.
Pseudoneoreomys leptorhynchus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.
Pseudoneoreomys mesorhynchus Amegh.; Ibid., p. 301.

This is by far the most abundant and best known species of the genus and from it most of the preceding generic description has been taken. In size, the species is very variable, some individuals much surpassing others in this respect. Much of this variation is, however, due to differences of age, as growth evidently continued till a comparatively late period of life, and every stage of transition between the extremes may be observed. The teeth, on the other hand, are quite constant, except as their form and size are altered by abrasion.

The incisors have slightly, but distinctly, convex faces and $p_{\overline{4}}$ has no groove upon the outer side of the anterior prism.

In the following table, Nos. 15,222 and 15,396 are young individuals, 15,572 and 15,365 adult, while 15,266 was an old animal with much worn teeth.

MEASUREMENTS.

	No. 15,222.	No. 15,396.	No. 15,572.	No. 15,365.	No. 15,266.
Upper dentition, length	.052		.056		.056
" " " $p^{\underline{4}}$–$m^{\underline{3}}$	.025		.024		.023
Upper incisor, width	.005		.005		.005
" " thickness	.005		.0045		.005
Lower dentition, length		.050		.048	.050
" " " $p_{\overline{4}}$–$m_{\overline{3}}$		.025		.025	.027
Skull, length in median basal line	.085		.096		
" " over all	.094		.102		.103

	No. 15,222.	*No. 15,396.*	*No. 15,572.*	*No. 15,365.*	*No. 15,266.*
Cranium, length, occipital condyle to rim of orbit			.056		
Face, length, orbit to end of rostrum			.048		
Occiput, height			.030		
" width at base			.039		
Skull, width behind zygomatic process			.039		.040
" " in interorbital region			.030		.032
Rostrum, width at anterior end	.019		.018		.021
Mandible, length from condyle		.068		.070	
" depth below m_1		.013		.014	.015

NEOREOMYS PACHYRHYNCHUS (Ameghino).

Pseudoneoreomys pachyrhynchus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 300.

Certain skulls in the collections are so large and heavy that they probably represent a species different from the preceding one, especially as they are not closely connected by transitional forms with the average individuals of *N. australis*. To these large animals the name *N. pachyrhynchus* Amegh., may be applied, as the broad and heavy rostrum is a very characteristic feature. The type specimen appears to be rather smaller than the somewhat crushed and distorted skull in the collection of the American Museum of Natural History (No. 9,130) from which the following measurements are taken. The type is, however, so incomplete as to permit little direct comparison.

MEASUREMENTS.

Upper dentition, length	.059	Occiput, height	.032
" " " p^4–m^3	.024	" width at base	.040
Upper incisor, width	.006	Skull, width behind zygomata	.044
" " thickness	.006	" " in interorbital region	.036
Skull, length over all	.109	Rostrum, width at anterior end	.028

There remain two species of *Neoreomys*, which Ameghino has described and which are probably valid, though as each is known only from the type specimen, it is possible that they are merely abnormal individuals.

NEOREOMYS DECISUS, Ameghino.

Neoreomys decisus Amegh.; Enumeracion sistemat., etc.; 1887, p. 11.

In size this species is much the same as *N. australis*, from which it is distinguished by the lower incisor. This tooth has a plane, instead of convex, anterior face and near the mesial border are two faintly marked, longitudinal grooves.

NEOREOMYS VARIEGATUS Ameghino.

(Plate LXV, Fig. 12.)

Neoreomys variegatus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 68.

The distinctive character of this species is to be found in $p_{\overline{4}}$, of which the anterior prism has a well defined vertical groove on the outer side, a feature which is not present in any of the other species. Size as in *N. australis.*

SCLEROMYS Ameghino.

(Plate LXV, Figs. 13–15.)

Scleromys Amegh.; Enumeracion sistemat., etc., 1887, p. 11.
Neoreomys Amegh.; in part.

This genus is much like the preceding one, from which it is distinguished by its smaller size and by the simpler pattern of the grinding teeth. Individuals of *Scleromys* are quite rare and it is far less completely known than *Neoreomys;* not even a well preserved skull has yet been found and the skeleton is entirely unknown. The incisors resemble those of *Neoreomys* in character, but are slightly broader in proportion to the length of the grinding series; the anterior faces are more or less convex and have a crêpe-like surface, produced by faint, wavy longitudinal striations. The upper grinding teeth are divided into two prisms by a deep internal fold, which extends obliquely across the crown almost to the external wall; on more advanced wear the outer part of this fold is separated as a lake. A second and much shallower fold invades the posterior prism from the outer side, but is very early isolated as a lake. In advanced stages of wear even the internal fold loses its connection with the peripheral enamel and then the crown has three lakes, an anterior transverse pair formed from the internal fold, and a posterior lake derived from the external fold. In the lower teeth the pattern is, as usual, reversed, the principal enamel fold being external and posterior, and the secondary fold internal and posterior.

So far as the skull is known, it is much like that of *Neoreomys*, with certain characteristic differences. The parietal region of the cranium is broader and more flattened, contracting posteriorly to a short, narrow sagittal area, without trace of a sagittal crest. The palate is distinctly wider and the posterior narial opening conspicuously so, not only proportionately, but actually, and is of a somewhat different shape, the front border of the opening being more regularly curved and without median spine. The incisors extend farther into the maxillaries, the preorbital portion of which is relatively somewhat longer than in *Neoreomys*.

From all the known material, it seems sufficiently evident that *Scleromys* is closely allied to *Neoreomys*. Ameghino has suggested ('94^a, 69) that it is ancestral to *Ctenomys*, but the character of the teeth seems to forbid such an association, while the skull is of quite a different type.

SCLEROMYS ANGUSTUS Ameghino.

(Plate LXV, Figs. 13, 14.)

Scleromys angustus Amegh.; Enumeracion sistemat., etc., 1887, p. 11.
?*Neoreomys limatus* Amegh.; Revist. Argent. de Hist. Nat., T. I, 1891, p. 142.

The type and possibly the only species. It is distinguished by its somewhat smaller size and more slender proportions, and by the more convex faces of the incisor teeth.

The type of *Neoreomys limatus* is a mandible with much abraded teeth; it is apparently referable to the present species, with which it agrees in size.

In the subjoined table the dimensions of the upper jaw are taken from a palate, with teeth, in the collection of the American Museum of Natural History (No. 9,304) and those of the lower jaw from a specimen in the Ameghino collection.

MEASUREMENTS.

Upper dentition, length	.044	Palate, width at p^{4}	.006
" " " p^{4}–m^{3}	.018	" ", " m^{3}	.012
" " " m^{1}–m^{3}	.013	Lower dentition, length	.035
Upper incisor, width	.004	" " " p_{4}–m_{3}	.020
" " thickness	.0043	" " " m_{1}–m_{3}	.013

SCLEROMYS OSBORNIANUS Ameghino.

(Plate LXV, Fig. 15.)

Scleromys osbornianus Amegh., Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 69.

To this species Ameghino refers an imperfect skull and a mandible, which apparently belong to different individuals, without indicating either as the type. The skull is larger and more robust than that of *S. angustus*, though the length of the grinding series is the same, or but little greater; the incisors also are somewhat flattened.

MEASUREMENTS.

Upper dentition, length $p^{\underline{4}}$–$m^{\underline{3}}$	.018	Lower dentition, length $p_{\overline{4}}$–$m_{\overline{3}}$	.022
" " " $m^{\underline{1}}$–$m^{\underline{3}}$	.013	" " " $m_{\overline{1}}$–$m_{\overline{3}}$	.016
Upper incisor, width	.004		

There remain two interesting, but very incompletely known genera, the position of which within the family is uncertain, though the molar pattern renders probable the reference of them to the *Capromyinæ*. These genera differ from all other known Santa Cruz rodents in having but three grinding teeth.

LOMOMYS Ameghino.

Lomomys Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 301.
Neoreomys Amegh.; in part.

From the position of the upper teeth in the jaw and their relation to the posterior nares and to the zygomatic process of the maxillary, it is probable that the dental formula should be written $p^{\underline{0}}\ m^{\underline{3}}$. The molar pattern resembles that of *Scleromys*, with two principal enamel folds, an anterior one from the inner side and a posterior one from the outer side, with a minute enamel lake lying behind the latter. In the unworn state $m^{\underline{3}}$ appears to be composed of three transverse laminæ. The two dental series pursue an almost parallel course, without marked anterior convergence.

The hard palate, which is of nearly uniform width, is short and anteroposteriorly convex, rising steeply opposite $m^{\underline{1}}$; the posterior palatine foramina are in the palatine bones.

The only known species is

LOMOMYS INSULATUS Ameghino.

(Plate LXV, Fig. 27.)

Neoreomys insulatus Amegh.; Contrib. al Conoc. Mam. Fos. de la Repúb. Argent.; 1889, p. 138.

Lomomys evexus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 301.

Lomomys insulatus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 69.

Size a little smaller than *Scleromys angustus*, the upper grinding series measuring 13.5 mm. in length; the molars diminish gradually in size from $m^{\underline{1}}$ to $m^{\underline{3}}$.

OLENOPSIS Ameghino.

Olenopsis Amegh.; Contrib. al Conoc. Mam. Fos. de la Repúb. Argent.; 1889, p. 145.

Of this rare genus I have seen no Santa Cruz examples, but only a cast of the Paraná species, *O. typicus*, which has $dp_{\overline{4}}$ in place, with $p_{\overline{4}}$ showing beneath it; the dental formula is thus $p_{\overline{1}}$ $m_{\overline{2}}$. In the unworn state the molars are composed of three transverse and somewhat oblique laminæ, of which the middle one is the longest; the folds contain thin deposits of cement. On wear, the enamel folds are isolated from the peripheral enamel and form lakes.

OLENOPSIS UNCINUS Ameghino.

Olenopsis uncinus Amegh.; Contrib. al Conoc. Mam. Fos. de la Repúb. Argent.; 1889, p. 145.

Characterized by the broad incisors, which have convex faces, and by the comparative simplicity of $m_{\overline{2}}$, which is similar in pattern to $m_{\overline{1}}$, whereas in the later *O. typicus*, from the Paraná beds, it is more complex. In size, *O. uncinus* is comparable to *Neoreomys australis*.

LONCHERINÆ.

In addition to the foregoing genera, which are, for the most part, comparatively large animals, the family was represented in Santa Cruz times by a number of smaller rodents, some of them extremely small, in which the grinding teeth are shorter-crowned and have distinct roots. As yet, these genera are known almost entirely from the teeth, imperfect skulls of *Stichomys* and *Spaniomys* only having been found and nothing has been learned of the skeleton. The upper grinding teeth have one internal and two or more external folds of enamel, the number of the latter differing in each genus; in the lower teeth the pattern is reversed, or it may be somewhat simpler.

In molar pattern, the genera of the subfamily form a continuous series of increasing complexity, which may be tabulated thus:

A. Lower grinding teeth with two internal folds.
    a. Incisors with convex faces.................................*Stichomys.*
    b. Incisors with plane faces ....*Adelphomys.*
B. P$_{\overline{4}}$ and m$_{\overline{1}}$ with three internal folds, m$_{\overline{2}}$ and $_{\overline{3}}$ with one.............*Gyrignophus.*
C. P$_{\overline{4}}$, m$_{\overline{1}}$ and $_{\overline{2}}$ with three internal folds, m$_{\overline{3}}$ with one..................*Spaniomys.*
D. M$_{\overline{1}-\overline{3}}$ with three internal folds, p$_{\overline{4}}$ unknown ....*Graphimys.*

STICHOMYS Ameghino.

(Plate LXV, Figs. 16–20^a.)

Stichomys Amegh.; Enumeracion sistemat., etc.; 1887, p. 10.

This genus comprises small rodents, with rooted molars and narrow incisors, of which the thickness exceeds the breadth and of which, except in one species, the anterior faces are strongly convex. The size of the grinding teeth varies considerably with age, diminishing and becoming more uniform as abrasion advances. The molar pattern is simpler than in the other genera of the subfamily, *Adelphomys* excepted. In the upper jaw the teeth have each one deep and narrow enamel fold from the inner side and nearly opposite to this a corresponding external fold, the two being connected in unworn specimens; in front of the principal external fold is another and somewhat shallower fold from the outer side, and in quite unabraded teeth is probably a third, posterior external fold. I have seen no specimen, however, in which this hindermost valley is not already converted into a lake. As abrasion increases, the anterior fold first becomes isolated and finally even the principal internal and external folds are cut off, the peripheral enamel becoming continuous and enclosing four lakes. The lower molars are somewhat simpler in pattern, having one external and two internal folds and lacking the posterior fold of the upper teeth. I have seen no example of the milk teeth; dp4 was probably shed very early, as the premolar is always the most worn of the permanent teeth.

The skull is very incompletely known and in none of the individuals is the significant occipital and periotic region preserved. The upper contour of the skull is slightly arched in the antero-posterior direction, very much as in *Loncheres.* Seen from above, the general appearance of the skull has considerable resemblance to that of the recent genera, *Echimys* and

Loncheres, but is more elongate, with narrower and less tapering cranium and somewhat broader rostrum than in the latter. There is no sagittal crest, but on the hinder half of the parietals is a short, narrow and obscurely marked sagittal area, which in front suddenly expands to the full width of the cranium, its borders becoming confluent with the supraorbital ridges. The coronal suture is not so straight as in the modern genera, but is slightly curved, with concavity forward. The supraorbital border is quite as prominent as in the recent genera and has a well defined postorbital process not present in the latter. The frontals are nearly flat, except anteriorly, when they show a pair of inconspicuous swellings produced by the sinuses. The nasals are relatively quite large and of somewhat foliate shape, broadening and becoming very convex anteriorly, where they are curved down on the sides of the rostrum; posteriorly, they notch the frontals more deeply than in the modern genera. The premaxillaries are much as in *Loncheres* and the anterior border, in front of the incisor alveoli, forms a similar sharp vertical keel, but the incisive foramina are considerably larger and the ascending rami, which extend to the frontals, are broader. The posterior nares and hard palate resemble those of *Echimys*, but the palate is rather more triangular, owing to the slight anterior convergence of the two dental series.

The mandible differs from that of *Echimys* and *Loncheres* in a number of particulars. The ascending ramus is set farther back, so that $m_{\overline{3}}$ is but partly concealed when the jaw is viewed from the side, while in the recent genera this tooth is entirely hidden; the coronoid process, though small, is much less reduced than in the two recent genera, and the sigmoid notch is correspondingly deeper; the masseteric crest, which pursues a similar course, is less prominent and does not extend so far forward; the anterior part of the horizontal ramus is less inclined ventrally.

Specimens of *Stichomys* are not at all uncommon and the genus is represented in the Santa Cruz beds by a considerable number of species, which differ markedly in size. However, as these species have all been established upon jaws, better material may well modify the results.

STICHOMYS REGULARIS Ameghino.

(Plate LXV, Figs. 17–19.)

Stichomys regularis Amegh.; Enumeracion sistem., etc.; 1887, p. 10.

The typical species is of moderate size and has a narrow, tapering rostrum, the incisors are narrow and appear to be even more so than they actually are, because of the strong convexity of their anterior faces.

MEASUREMENTS.

	No. 9,512.	*No. 15,555.*	*Amegh. Col.*
Upper dentition, length	.029	.028	
“ “ “ $\mathrm{p}^{\underline{4}}$–$\mathrm{m}^{\underline{3}}$	.013	.013	
“ “ “ $\mathrm{m}^{\underline{1}}$–$\mathrm{m}^{\underline{3}}$	.010	.010	
Upper incisor, width	.002	.002	
“ “ thickness	.0025	.0025	
Lower dentition, length			.022
“ “ “ $\mathrm{p}_{\overline{4}}$–$\mathrm{m}_{\overline{3}}$			.013
“ “ “ $\mathrm{m}_{\overline{1}}$–$\mathrm{m}_{\overline{3}}$			.0095

STICHOMYS REGIUS Ameghino.

(Plate LXV, Figs. 16, 20, 20^a.)

Stichomys regius Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 70.

This species is distinguished from the preceding one by its somewhat larger size and more robust proportions and by the broader rostrum and heavier incisors. So far as the available material goes, these differences appear to be quite constant, though it is quite possible that more numerous specimens might show them to be merely individual variations. The following measurements of the upper teeth are taken from a specimen in the collection of the American Museum of Natural History (No. 9,495) and those of the lower teeth from a mandible in the Princeton Museum (No. 15,423).

MEASUREMENTS.

Upper dentition, length	.033	Upper incisor, thickness	.003
“ “ “ $\mathrm{p}^{\underline{4}}$–$\mathrm{m}^{\underline{3}}$	.0145	Lower dentition, length	.026
“ “ “ $\mathrm{m}^{\underline{1}}$–$\mathrm{m}^{\underline{3}}$	.011	“ “ “ $\mathrm{p}_{\overline{4}}$–$\mathrm{m}_{\overline{3}}$	.015
Upper incisor, width	.0025	“ “ “ $\mathrm{m}_{\overline{1}}$–$\mathrm{m}_{\overline{3}}$	.0115

STICHOMYS ARENARUS Ameghino.

Stichomys arenarus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 70.

In this species, which is as yet known only from a single mandible, the series of grinding teeth has the same length as in *S. regularis*, but the horizontal ramus of the jaw is so much more slender as to give it quite a different appearance from that of the typical species.

STICHOMYS PLANUS Ameghino.

Stichomys planus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 299.

This species differs from all the other known members of the genus in having incisors with plane faces, as in *Adelphomys*, but differing from the latter in proportions, which are those of *Stichomys*, the thickness exceeding the width.

Ameghino has named three other species of *Stichomys*, founded upon differences of size. I have seen no examples of these species.

STICHOMYS CONSTANS Ameghino.

Stichomys constans Amegh.; Enumeracion sistem., etc.; 1887, p. 10.
Stichomys gracilis Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.

"The lower incisor has a width of hardly more than 1 mm. and the four inferior molars occupy a longitudinal space of 9 mm.; the length of the diastema is 3.5 mm. and the height of the horizontal ramus below the first molar [$\text{p}_{\overline{4}}$] is 5.5 mm." (Amegh., 89^b, p. 140.)

S. gracilis appears to be identical with *S. constans*, for, though described as considerably smaller, its dimensions, as given, are almost exactly the same; viz., length $\text{p}_{\overline{4}}$–$\text{m}_{\overline{2}}$, 5.8 mm.; depth of jaw below $\text{p}_{\overline{4}}$, 5.5 mm.

STICHOMYS DIMINUTUS Ameghino.

Stichomys diminutus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.

"Size considerably less than that of the preceding species [*i. e.*, *S. gracilis*], the first two lower molars occupy a longitudinal space of only 3 mm." (Amegh., *loc. cit.*)

ADELPHOMYS Ameghino.

Adelphomys Amegh.; Enumeracion sistem., etc., 1887, p. 10.

Closely allied to *Stichomys* and having similar grinding teeth, but distinguished by the incisor teeth which have plane faces and in which the width equals or exceeds the thickness, thus reversing the proportions found in the incisors of *Stichomys*.

ADELPHOMYS CANDIDUS Ameghino.

Adelphomys candidus Amegh.; Enumeracion sistem., etc.; 1887, p. 10.

The typical and somewhat smaller species is distinguished by narrower incisors and more slender horizontal ramus of the mandible. The lower grinding series is 14 mm. long and the lower incisor is 2 mm. wide.

ADELPHOMYS EXIMIUS Ameghino.

Adelphomys eximius Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 69.

This is a rather more robust animal than the preceding one, with heavier lower jaw and broader incisors, which measure 2.5 mm. in width.

GYRIGNOPHUS Ameghino.

Gyrignophus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.

The original description of this genus reads as follows: "Of characters intermediate between *Spaniomys* and *Stichomys.* The first two lower molars [*i. e.*, $p_{\overline{4}}$ and $m_{\overline{1}}$] have three folds on the inner side and the last two only two." On making an enlargement of the photograph which I took of the type specimen it appeared that $m_{\overline{2}}$ also had three internal folds, the median one of which is much narrower and shallower than the others, and is filled with matrix, so as to be very difficult to see. The tooth has therefore been figured (Pl. LXV, fig. 25) with three such folds, though I do not feel entirely confident that such an interpretation is correct. At all events, the pattern of $m_{\overline{2}}$ is sufficiently different from that of *Spaniomys* to justify the generic distinction. (Cf. figs. 23 and 25, Pl. LXV.) It is further evident that $m_{\overline{3}}$ is only beginning to take on the full complication of the preceding teeth.

The only species yet known is

GYRIGNOPHUS COMPLICATUS Ameghino.

(Plate LXV, Fig. 25.)

Gyrignophus complicatus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.

This is a very small animal, about equal to *Stichomys constans* in size. The series of inferior grinding teeth is 10 mm. in length and the depth of the horizontal ramus below $p_{\overline{4}}$ is 6 mm.

SPANIOMYS Ameghino.

(Plate LXV, Figs. 22–24.)

Spaniomys Amegh.; Enumeracion sistem., etc.; 1887, p. 10.

Closely allied to *Stichomys*, but with grinding teeth of much more complex pattern and comprising species which are of much smaller size than those of *Stichomys*. Although it is one of the commoner Santa Cruz rodents, this genus is still very incompletely known, and only from jaws and more or less fragmentary skulls, no other part of the skeleton having yet been found.

The incisors are very delicate and have convex faces, with thickness slightly exceeding width. The upper grinding teeth have a single internal fold and $p^{\underline{4}}$ is simpler than the others in having but two external folds, while the molars have three such folds, which are broad and deep and of V-shaped cross-section, thus producing four sharp and prominent external vertical ridges. The molar pattern is thus highly complex and characteristic. Each of the upper dental series is curved, with the convexity of the curvature inward, so that the two rows approximate each other most nearly at about the middle of their course, while the ends are more widely separated.

In the mandibular teeth the pattern is reversed, with single external fold; in $p_{\overline{4}}$, $m_{\overline{1}}$ and $_{\overline{2}}$ there are three internal folds, while $m_{\overline{3}}$ has but two, like $p^{\underline{4}}$.

The resemblance of the upper teeth of *Spaniomys* to those of the recent *Kannabateomys* is very close and striking, except that in the latter $p^{\underline{4}}$ has three external folds, like the molars. On the other hand, the lower teeth of the modern genus, except $p_{\overline{4}}$, are less complicated than those of *Spaniomys* and are more like those of *Stichomys*.

So far as it is possible to make comparisons, the skull closely resembles that of *Stichomys* and is also much like that of the recent *Echimys*, though the upper contour is straighter and the cranium relatively narrower. In one specimen the occiput is retained, though in such a badly fractured condition as to render exceedingly difficult any determination of the sutures in this region. The occiput is like that of *Loncheres*, though somewhat narrower, while the paroccipital processes are longer and are attached to the largely inflated tympanic bullæ. Apparently, the supraoccipital has very small lateral processes, which do not extend downward upon the periotics, but are separated from them by the supramastoid processes of the squamosals. No sagittal crest is present and the short sagittal area is defined on each side by a depression of the cranial roof, producing quite a different appearance from the broadly arched and rounded cranium of *Loncheres* and *Echimys*. The supraorbital ridges of the frontals are not extended so far backward as in *Stichomys* and there appears to be no postorbital process; the forehead is nearly flat, the sinuses causing but slight eminences. The lachrymal is extremely small, as much reduced as in the modern genera named; the infraorbital foramen has no separate division for the nerve. The rostrum is relatively longer than in *Loncheres* and its ventral surface is more raised above the level of the hard palate. The interdental portion of the palate is quite short, owing to the extension of the posterior nares, which make a deep, V-shaped incision, with front border almost opposite the middle of $m^{\underline{2}}$, thus resembling *Echimys* rather than *Loncheres*.

The mandibles are all incomplete, lacking the coronoid, condyle and angle; the masseteric crest is prominent and the fossa is deeper than in *Stichomys*. In some individuals enough of the ascending ramus is preserved to show that the coronoid was better developed than in *Echimys* and *Loncheres*, and that it was set farther back, hardly concealing $m^{\underline{3}}$; so far as it is preserved, its ventral border is rounded, not flattened, and the pterygoid crest, if present, cannot have been so developed as in the last-named recent genera. As compared with that of *Stichomys*, the ascending ramus is less erect, more inclined backward.

Relationships. — It is evident that this genus is nearly allied to the existing members of the subfamily, but, from the complexity of the dentition, it seems unlikely that it was directly ancestral to any of them. Materials are, however, lacking for a definite decision of this latter question.

SPANIOMYS RIPARIUS Ameghino.

(Plate LXV, Figs. 22, 23.)

Spaniomys riparius Amegh.; Enumeracion sistem., etc.; 1887, p. 10.

The typical species is distinguished by somewhat larger size, which is about equal to that of *Echimys cayennensis*, the length of the lower grinding series varying from 10.5 to 13 mm. in length, and in most individuals is about 12 mm. The external columns of all these teeth are undivided. In the subjoined table the measurements of the upper teeth and skull are from an American Museum specimen, No. 9,529.

MEASUREMENTS.

Upper dentition, length	.025	Lower incisor, width	.0015
" " " $p^{\underline{4}}$–$m^{\underline{3}}$	.012	" " thickness	.002

Upper dentition, length m^1–m^3	.009	Skull, length condyle to premaxillary	.048
Upper incisor, width	.0015	Cranium, length to rim of orbit	.031
" " thickness	.002	Face, length	.017
Lower dentition, length	.024	Occiput, height	.011
" " " p_4–m_3	.013	Mandible, depth below p_4	.008
" " " m_1–m_3	.010		

SPANIOMYS MODESTUS Ameghino.

Spaniomys modestus Amegh.; Enumeracion sistem., etc.; 1887, p. 10.

This species, which is much less common than the preceding one, and is known only from mandibles, is distinguished chiefly by its smaller size; the series of lower grinding teeth measures only 9 mm. in length and the depth of the jaw below p_4 is only 5.5 mm.; the anterior portion of the mandible is lower, more slender and relatively more prolonged than in *S. riparius.*

SPANIOMYS BIPLICATUS Ameghino.

(Plate LXV, Fig. 24.)

Spaniomys biplicatus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonia, 1894, p. 70.

A well-marked species, so distinct, indeed, that it may perhaps be referable to a different genus. In size it is slightly smaller than the average individual of *S. riparius.* The upper teeth are not known; in the lower teeth the anterior of the two external prisms, into which the crown is divided by the broad and deep median enamel fold, is itself subdivided by a vertical groove into two crests. The type specimen does not make it clear whether this subdivision is present in all of the grinding teeth, or only in m_1 and $_3$. Length of lower grinding series = 11 mm.

GRAPHIMYS Ameghino.

Graphimys Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.

This genus, though known only from a single fragment of the mandible, appears to be very distinct and carries the complexity of molar pattern in this subfamily to its maximum. Like the other grinding teeth m_3, has on the inner side three enamel folds and four crests; the additional fold is produced by a groove subdividing the median crest, but differs from the other folds and from the corresponding fold of the other teeth in being much shallower and more widely open.

GRAPHIMYS PROVECTUS Ameghino.

(Plate LXV, Fig. 26.)

Graphimys provectus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 300.

This is a very small animal, about equalling *Spaniomys modestus* in size. Length $m_{\overline{1}-\overline{3}} = 7$ mm.

ERETHIZONTIDÆ.

ERETHIZONTINÆ.

STEIROMYS Ameghino.

(Plate LXVI, Figs. 1–9.)

Steiromys Amegh.; Enumeracion sistem., etc.; 1887, p. 9.

It is interesting to note that this genus is more like the recent North American *Erethizon* than it is like the modern South American genera of the same family. Indeed, it is difficult to frame a generic diagnosis which will satisfactorily separate it from *Erethizon*, though there are many differences of detail and the number of these differences would doubtless be increased, if more complete material were accessible.

The incisors are very heavy, conspicuously more so than in the recent genera, and may either be of equal width and thickness, or the latter dimension may be slightly greater. In the upper jaw the incisors have feebly convex faces and are very much curved antero-posteriorly, ending in front of $p^{\underline{4}}$; in the mandible the faces are plane, with very narrow and shallow groove near the external border, which is raised and pillar-like; these teeth are much longer than in the modern genera of the family and extend behind $m_{\overline{3}}$ into the ascending ramus, which gives quite a different appearance to this region of the jaw.

The grinding teeth have the same pattern as in *Erethizon* and *Coendou*, with low crowns, covered with thick enamel, and long roots; in the masticating surface the valleys are hardly so deep as in the former, but the anterior valley is complicated by a more or less interrupted ridge, which is not present in the recent genera. The two rows of upper teeth are nearly parallel, and though slightly more convergent anteriorly than in *Coendou*, are much less so than in *Erethizon*. I have seen no example of the milk-teeth, though it is evident from the comparative degree of abrasion that dp4 long remained in function and was not replaced until after m3 had come into use. Ameghino states that there are two milk-premolars, one of which has no successor (94^e, 67).

The skull (Plate LXVI, figs. 1–6) concerning which some significant points remain to be determined, is, in general appearance, much more like that of *Erethizon* than that of *Coendou*, which is principally due to the absence of the inflation of the frontal and nasal regions so characteristic of the latter. A short, but well defined sagittal crest, which is much more prominent than in *Erethizon*, occupies the posterior half of the parietal zone, passing forward abruptly into a lyrate sagittal area, which is much narrower and has more nearly parallel sides than in the last-named genus. The nasals are longer and more convex transversely than in the latter, and the dorsal branch of the maxillary zygomatic process is broader, or less antero-posteriorly compressed than in either of the recent genera. The rostrum has about the same relative length as in *Erethizon*, but is of more uniform width, not narrowing so much ventrally and thus, when viewed from below, is more as in *Chætomys* than in either of the other modern genera. The incisive foramina are large, resembling those of *Erethizon*. None of the specimens shows the shape or limits of the posterior nares. The pterygoids have a wider ventral surface than in the recent genera and do not extend to the tympanic bullæ; apparently the pterygoid fossa is imperforate, though the skulls are all so damaged here as to leave this somewhat uncertain. The tympanic bullæ are far smaller than in *Erethizon* or *Coendou*, with meatus formed by short, irregular tube, much as in the former.

The mandible differs in several respects from that of the recent genera; the symphysis is shorter and the chin more vertical, and the diastema is relatively much shorter; the ascending ramus is not set quite so far forward and the coronoid is much less reduced, rising above the level of the condyle, while the sigmoid notch is wider and shallower; the masseteric crest is much more prominent and the fossa much deeper and better defined; the pterygoid crest, on the other hand, is less developed, so that the ventral border of the angle is narrower and less inflected; the angular process is shorter and the notch between condyle and angle shallower. The alveolus of the incisor forms a broad, shelf-like projection from the inner side of the ascending ramus, rising much higher than in the recent genera and bringing the inferior dental foramen to a much more elevated position, a little below the condyle.

Of the skeleton, nothing is known but the tibia, fibula, pes, and parts of the ulna and manus of *S. duplicatus.* The manus (Plate LXVI, fig. 8) is relatively larger than in *Erethizon.* The lunar, which is not coössified with the scaphoid, is broad and very short proximo-distally, the radial facet extending over nearly the whole dorsal face. The pyramidal is much shorter than *Erethizon*, hardly more than a flat scale, thinning to an edge on the ulnar side. A distinct central was present, as is shown by the facets of the magnum, which is relatively much smaller than in *Erethizon*, while the unciform is quite as in the latter; the same is true of the pisiform, which resembles that of the modern genus, but is relatively shorter and more expanded at the free end.

The metacarpals preserved are II, III, IV and V. It is not practicable to determine whether the pollex was developed or rudimentary, for the facet on metacarpal II is not decisive, though, judging from the analogy of the pes, it seems probable that the pollex was functional. The other metacarpals are remarkably long and slender, especially II, III and IV. Metacarpal II is rather longer than V, shorter than III or IV; the proximal end is oblique to the shaft in both directions, so as to give the bone a somewhat twisted appearance; the facet for the trapezoid is less concave than in *Erethizon* and that for the magnum is somewhat smaller than in the latter; on the radial side of the head is an articular surface for the trapezium or for I.

Metacarpal III is the longest of the series; it differs from that of *Erethizon* in having a well-defined process which overlaps the head of metacarpal IV and abuts against the unciform, while in the recent genus there is no dorsal connection with the unciform. The shaft is slender and curved forward; the hemispherical distal trochlea is prominent, with a well-defined, though shallow, supratrochlear fossa.

Metacarpal IV is somewhat shorter and considerably stouter than III, especially toward the distal end, where it becomes irregular. Metacarpal V is much shorter than IV and relatively heavier.

The phalanges are very similar to those of *Erethizon*, but not so long in proportion to the metacarpus. The proximal phalanx is elongate, slender and depressed, with slightly oblique proximal and distal facets; the second phalanx is also quite long and the ungual forms a long, curved and pointed claw, cleft at the distal end.

The tibia, which is separate from the fibula, as in *Erethizon*, is short and heavy and shaped very much as in the latter; the distal end is rather wide, but not much thickened; the astragalar surface is unequally divided into small internal and very large external facets, with low intercondylar ridge, which on the plantar side passes into a long and prominent tongue-like process. The fibula is very slender, relatively more so than in *Erethizon*, and its distal end is more compressed laterally and expanded antero-posteriorly.

The pes (Plate LXVI, fig. 9) is very like that of *Erethizon*, with longer metatarsals and less reduced hallux; certain resemblances to *Coendou*, such as the presence of a second tibial sesamoid, are also to be noted. The calcaneum has a short, heavy tuber, with broad and shallow tendinal sulcus on the free end; the distal, external tuberosity for the attachment of the lateral ligament is a prominent ridge; the sustentaculum is very prominent and the external astragalar facet is very large and oblique, facing inward more than dorsally; the cuboid facet is oblique to the long axis of the bone and but slightly concave. The astragalus is short, wide and depressed, with deeply grooved and asymmetrical trochlea, the outer condyle being much the larger; the neck is very oblique and directed strongly toward the tibial side, ending in a convex, somewhat depressed head: on the plantar side are two large facets for the calcaneum, the external one of which is continuous with the navicular surface.

The navicular is short and narrow, with a shallow concavity for the distal end of the astragalus; distally, it rests entirely upon the meso- and ectocuneiforms, the entocuneiform having only a lateral contact with it, as is also the case in *Coendou* and *Erethizon*. On the tibial side of the navicular is a large, thick and heavy sesamoid, which resembles that of *Coendou* in shape and connections; in the figure (LXVI, 9, *s*) its full size is not shown, because it is partly overlapped and concealed by the second sesamoid (*s'*). The first sesamoid rests upon the navicular and entocuneiform, entirely covering the proximal end of the latter, and on the fibular side it articulates extensively with the astragalus, for which it has a concave facet; on the tibial and dorsal side are two small, subcircular and well-separated facets for the second sesamoid. The latter, which is not present in *Erethizon*, has a somewhat similar shape to that seen in *Coendou*, but is far smaller and could have had no such functional importance; it is a flat bone, of subtriangular shape, and is connected only with the first sesamoid by means of two small facets on the inner side of the plantar surface.

The entocuneiform is a large bone, with principal diameter proximodistal, but it is also very thick planto-dorsally; the proximal facet for the first sesamoid is nearly plane and the distal one for the first metatarsal is saddle-shaped, while those for the navicular and second metatarsal are on the fibular side. The mesocuneiform is very small and the ectocuneiform is very large, both having nearly the same shape and proportions as in *Erethizon*. The cuboid also is very much as in the latter, but has a somewhat more oblique facet for the calcaneum and does not come into contact with the astragalus.

The metatarsus is remarkably elongate, exceeding the metacarpus in length much more than is the case in *Erethizon*. Metatarsal I is the shortest of the series, but is stout and well developed; the proximal end is broad and thick and bears a large, saddle-shaped facet for the entocuneiform. The shape of this facet and the divergent position of the whole hallux suggest that this digit was opposable, at least to a limited extent. The shaft is broad and antero-posteriorly compressed, and the distal trochlea, which is complete and has a low carina, is asymmetrical, being displaced toward the fibular side.

The remaining metatarsals differ little from one another in length, IV being slightly the longest and II and V almost equal; II, III and IV have slender shafts, of transversely oval section, and arched forward; the distal trochlea is hemispherical, with a small, but well defined, supratrochlear fossa above it, and a short, low carina on the plantar side. Metatarsal V has an expansion of the proximal end, which ends in a blunt projection from the fibular side, much as in *Erethizon*, but less heavy and prominent.

The phalanges differ from those of the manus only in being longer and heavier, the entire pes much exceeding the manus in all dimensions.

Relationships. — No reason is apparent, why we should not regard *Steiromys* as the actual and direct ancestor of *Erethizon*, an animal which is demonstrably of South American origin. The Santa Cruz genus is but little more primitive than the recent one and the change from one to the other involves but a slight modification. On the other hand, *Steiromys* may also be an ancestor of *Coendou*, as is suggested especially by the presence of the two sesamoids in the tarsus. So long, however, as we remain in complete ignorance of the character of the tail in the fossil, we can hardly decide this question. At all events, *Steiromys* must be near to the common ancestor of both the North and South American recent genera. It is interesting to note that the migrant, *Erethizon*, which is on the outskirts of the distributional area, has undergone less modification than *Coendou*, which has remained in the original home of the group.

STEIROMYS DETENTUS Ameghino.

(Plate LXVI, Figs. 6–7^a.)

Steiromys detentus Amegh.; Enumeracion sistem., etc.; 1887, p. 9.

This species is distinguished, not only by its smaller size, which is very constant in many specimens, but also by the symmetrical shape of $m_{\overline{3}}$, which is smaller than $m_{\overline{1}}$ or $_{\overline{2}}$. In the table, the measurements of the upper teeth and skull are from a specimen (No. 9,555) belonging to the American Museum, those of the lower teeth and mandible from No. 15,094 in the Princeton collection.

MEASUREMENTS.

Upper dentition, length	.044	Rostrum, width at anterior end	.016
Upper dentition, length $p^{\underline{4}}$–$m^{\underline{3}}$	.0195	Lower dentition, length $p_{\overline{4}}$–$m_{\overline{3}}$	.021
Upper dentition, length $m^{\underline{1}}$–$m^{\underline{3}}$	.014	Lower dentition, length $m_{\overline{1}}$–$m_{\overline{3}}$	.015
Upper incisor, width	.004	Lower incisor width	.004
" " thickness	.004	" " thickness	.004
Skull, estimated length	.085	Mandible, depth below $p_{\overline{4}}$	.014

STEIROMYS INTERMEDIUS sp. nov.

(Plate LXVI, Figs. 3–4^a.)

In size this species is intermediate between *S. detentus* and *S. duplicatus*, though it cannot be called transitional, because of the constancy of those two species in regard to size. However, size is not the only distinguishing character; the incisors are actually as large as in *S. duplicatus* and are therefore relatively much larger; in addition to the external raised border or pillar, is a similar, though much less distinct, pillar on the mesial border; between the two the anterior face is depressed and flat. The grinding teeth are rather small in proportion to the size of the jaw; $m_{\overline{3}}$ is reduced in size and asymmetrical, the posterior lobe of the tooth being much smaller than the anterior lobe.

The type of the species is a mandible, No. 15,367, in the Princeton Museum, and it is probable that the upper teeth from the Ameghino collection, shown at Plate LXVI, fig. 3, should also be referred to the same species.

MEASUREMENTS.

Lower dentition, length $p_{\overline{4}}$–$m_{\overline{3}}$	.025	Lower incisor, thickness	.0063
" " " $m_{\overline{1}}$–$m_{\overline{3}}$	.018	Mandible, depth below $m_{\overline{3}}$	.017
Lower incisor, width	.006		

STEIROMYS DUPLICATUS Ameghino.

(Plate LXVI, Figs. 1–2ª, 4, 5, 8, 9.)

Steiromys duplicatus Amegh.; Enumeracion sistem., etc.; 1887, p. 10.

This is a large rodent, much exceeding *Erethizon dorsatum* in size Whether the manus and pes (Pl. LXVI, figs. 8, 9), are properly referable to this species, is not certain, because no teeth were found associated with them, but they very probably are so referable, because, large as they appear, they are but little larger, in proportion to the size of the skull, than in the recent species. The incisors are larger and heavier than in the latter, but the grinding teeth are relatively smaller and the diastema actually shorter; the raised external border of the lower incisor is distinct, but there is no enamel ridge along the mesial border. A series of comparative measurements shows many differences of proportion from the Canada porcupine, which is therefore included in the tables. In the first table the individuals marked A.1 and A.2 are in the Ameghino collection.

MEASUREMENTS.

	A.1.	*A.2.*	*No. 15,868.*	*E. dorsatum.*
Upper dentition, length	.060			.054
" " " $p^{\underline{4}}$–$m^{\underline{3}}$	.027			.0245
" " " $m^{\underline{1}}$–$m^{\underline{3}}$	.0185			.018
Upper incisor, width	.0065			.0035
" " thickness	.007			.0045
Lower dentition, length			.049	.048
" " " $p_{\overline{4}}$–$m_{\overline{3}}$			.0295	.027
" " " $m_{\overline{1}}$–$m_{\overline{3}}$			.021	.0195
Lower incisor, width			.006	.003
" " thickness			.007	.005
Skull, length		.120		.089

	No. 15,156.	*E. dorsatum.*
Tibia, distal width	.020	.012
" " thickness	.016	.013

	No. 15,156.	*E. dorsatum.*
Fibula, distal width	.0085	.008
" " thickness	.011	.008
Metacarpal II, length	.023	.014
" " proximal width	.006	.004
" " distal width	.0055	.004
Metacarpal III, length	.027	.016
" " proximal width	.006	.004
" " distal "	.0055	.004
Metacarpal IV, length	.025	.016
" " proximal width	.006	.0045
Metacarpal V, length	.022	.014
" " proximal width	.0055	.005
Manus, digit III, phalanx 1, length	.014	.011
" " " " 2, "	.012	.0085
" " " " 3, "	.016	.015
Manus, digit III, length	.066	.049
" " IV, "	.064	.048
Astragalus, length	.023	.016
" width of trochlea	.014	.014
Calcaneum, length	.033	.024
Metatarsal I, length	.024	.011
" " proximal width	.009	.006
" " distal width	.006	.005
Metatarsal II, length	.034	.016
" " proximal width	.0055	.004
" " distal width	.007	.004
Metatarsal III, length	.036	.018
" " proximal width	.006	.005
Metatarsal IV, length	.038	.020
" " proximal width	.0065	.005
Metatarsal V, length	.035	.022
" " proximal width	.010	.009
Pes, digit I, phalanx 1, length	.016	.010
" " " " 2, "	?.016	.011
" " II, " 1, "	.018	.012
" " " " 2, "	.014	.009
" " III, " 1, "	.019	.012
" " " " 2, "	.013	.0085
" " IV, " 1, "	.0175	.013
" " " " 2, "	.014	.0085
" " " " 3, "	.017	.0155
" " I, length	.052	
" " IV, "	.075	
" " V, "	.077	

ACAREMYINÆ.

Ameghino has proposed this subfamily to include *Acaremys* and *Sciamys*, two of the smallest and most abundant of the Santa Cruz rodents. The propriety of marking the distinction between these genera and the *Erethizontinæ* is evident, but it may well prove to be the case that the group should be raised to family rank, for the resemblance to the other subfamily lies principally in the dentition, while in the skull and skeleton there are significant differences.

SCIAMYS Ameghino.

(Plates LXVI, Figs. 10–11ᵃ; LXVII, 1–3, 5–9.)

Sciamys Amegh.; Enumeracion sistem, etc.; 1887, p. 9.

Small rodents with low-crowned and rooted grinding teeth, much resembling those of *Steiromys* in pattern; the crown is divided into two lobes by opposite enamel folds, and each lobe has a secondary fold, or enamel lake, which disappears relatively early on wear. In both jaws the two series of grinding teeth are nearly parallel, or have a slight anterior divergence. The incisors vary considerably in the different species, but are usually very narrow and delicate; in the upper jaw, they may have either plane or slightly convex faces, but in the mandible they are always plane, except in *S. robustus*, in which they are feebly grooved. The lower incisors are very long, extending behind the molars into the ascending rami.

The skull and skeleton are still very incompletely known, but some significant facts have been ascertained. In its general appearance and proportions the skull is much like that of the recent *Echimys*, though with much less curved upper contour. In the only specimen that I have seen which retains the posterior portion of the cranial roof (Pl. LXVII, fig. 9), there is no trace of sagittal crest or area, though the individual was fully adult. The occiput is broad and low, gently convex in the middle, with very large foramen magnum and small, sessile, widely separated condyles; the paroccipital processes are small and well divided from the bullæ. As in this family generally, the supraoccipital has quite long lateral processes, which extend down on each side upon the periotics. The tympanic bulla is largely inflated, with auditory meatus in the form of a very short tube, less prominent and less complete dorsally than in *Erethizon*.

The periotic has a large exposure upon the occipital surface, sending up a tongue-like process between the squamosal and exoccipital, resembling the arrangement seen in *Dolichotis* rather than that in the *Erethizontinæ*. The supramastoid process of the squamosal is quite narrow, and between this process and the periotic is a deep groove, which is even more pronounced than in *Dolichotis*. The frontal zone is elongate and the forehead flat, without protuberances formed by the sinuses; the supraorbital ridges are decidedly more prominent than in *Erethizon*, and very short postorbital processes are present in some species, not in others. The dorsal ramus of the maxillary zygomatic process is broad, less compressed antero-posteriorly than in *Erethizon* and the lachrymal, though small, is considerably larger than in the latter. The proportions of the rostrum and nasals differ much in the various species. The hard palate is of nearly uniform width between the teeth; the posterior nares are narrow and V-shaped.

Known mandibles are all incomplete, lacking the condyle and angle; the masseteric crest is even more prominent than in *Steiromys* and the masseteric fossa deeper; the pterygoid crest also, as far as it is preserved, is better developed than in the last-named genus.

Considerable parts of the skeleton are associated with an individual of *S. varians* (No. 15,168) and with one of *S. latidens* (No. 15,944). All the bones are very small, slight and delicate. Compared with *Erethizon*, the differences are so many and so marked as to indicate a different manner of life; probably these animals were terrestrial rather than arboreal in habits.

As a whole, the neck is relatively a little longer than in *Erethizon*. The atlas has a remarkably large, subcircular neural canal, which proportionately far exceeds that in the recent genus, and the transverse processes are thinner and more prominent than in the latter. In the axis the centrum is broad and depressed and has a prominent ventral keel, and the the neural canal is very large. The succeeding cervicals are short and broad and all appear to have been without neural spines, a difference from *Erethizon*, while the transverse processes resemble those of the latter in their rod-like shape and in the very small development of the inferior lamella. The anterior thoracic vertebræ are very small and have very slender spines, which, though incomplete, appear to have been longer than in *Erethizon*. The sacrum probably consisted of four vertebræ, three of which are preserved, and two are in contact with the ilia. An isolated caudal from near the end of the tail is more slender and elongate than the corresponding vertebra of *Erethizon* and indicates a longer and thinner tail than in the latter.

The pelvis is slender in all its parts; the ilium has an elongate, narrow peduncle, expanding into an anterior plate, which is so crushed that its shape is not determinable, and no ilio-pectineal process is observable. So far as it is preserved, the ischium is laterally compressed and somewhat twisted, and has no distinct sciatic notch. The obturator foramen appears to be of a different shape from that of *Erethizon*, being narrower dorso-ventrally.

All the limb bones are very slender and fragile, with large, thin-walled medullary cavity. None of the fore limb bones is complete, but the parts preserved show that they were considerably shorter than those of the hind limb and that the difference was much more marked than in *Erethizon.*

The very small and slender humerus has a pronounced deltoid crest, quite like that of *Erethizon*, but extending somewhat farther distally; the internal epicondyle is very prominent and is perforated by a minute foramen which is not present in the modern genus; the trochlea is low and has no pronounced protuberance for the head of the radius; the supra-trochlear fossa is quite deep and at one point is perforated, though the anconeal fossa, which in *Erethizon* is quite deep, is in *Sciamys* almost obsolete; the supinator ridge is large.

The ulna is extremely slender and has a short olecranon, which, however, is relatively less reduced than in *Erethizon*, and the facet for the internal part of the humeral trochlea is smaller than in the latter; the shaft is laterally compressed, becoming very thin toward the distal end, and has a distinct sigmoid curvature.

The carpus is not known. Of the metacarpus, metacarpals II, III and IV are preserved and these indicate that the manus was probably pentadactyl. The metacarpals named are not unlike those of *Erethizon* in shape, but are much shorter and more slender in proportion to the bones of the pes. Metacarpals II and III are of nearly equal length and articulate on the ulnar side with the magnum and the unciform respectively; IV is considerably shorter. In connection with the latter the phalanges are preserved. Of these the first and second are not especially characteristic, but the ungual is remarkably slender and straight, not very sharply pointed and with only a minute cleft at the tip; the ventral surface is flat and slightly broadened, remotely suggesting the unguals of certain hoofed animals, and the subungual process is only moderately developed; the claws must have been quite different from those of *Erethizon*.

The hind limb is disproportionately longer than the fore and all its elements are much longer. Relatively to the skull, the femur is somewhat shorter than in *Erethizon*, but is much longer in comparison with the humerus. The head is large, hemispherical, set upon a much constricted neck and presenting almost directly inward; the great trochanter is low, but thick, enclosing a small, deep digital fossa; the second trochanter is low, conical and so completely posterior as to be concealed when the bone is seen from the front; there is no third trochanter. The shaft is slender, straight and nearly cylindrical, in marked contrast to the broad, antero-posteriorly compressed femur of *Erethizon*, and the rotular groove is narrower, deeper and has better defined margins than in the latter; the condyles are small and project little behind the plane of the shaft.

The tibia (Plate LXVII, fig. 2) is rather longer than the femur, thus reversing the proportions of *Erethizon;* it is very slender and has a slight, though distinct, sigmoid curvature; the cnemial crest varies in development in the two species of which the tibia is known, being much more prominent in *S. latidens* than in *S. varians;* the distal end resembles that of *Steiromys*, with rather more prominent intercondylar ridge and shorter posterior tongue; the internal malleolus is almost bisected by a deep tendinal sulcus.

The fibula, the proximal end of which is not known, has an extremely slender, thread-like shaft; the distal third appears to have been closely applied to the tibia, though without ankylosis; the distal end resembles that of *Steiromys* rather than that of *Erethizon.*

The pes (Plate LXVII, fig. 3) is not unlike that of *Steiromys*, though with certain noteworthy differences. The calcaneum has a relatively longer and more slender tuber, the free end of which is hardly grooved, and the external prominence near the distal end, for the attachment of the lateral ligament is much less conspicuous. The astragalus has an even more asymmetrical trochlea, the internal condyle being hardly more than a sharp ridge; the neck has no such strong inclination toward the tibial side, but is nearly in the proximo-distal axis of the bone. The navicular is even narrower in proportion to its length than that of *Steiromys* and, as in that genus, has distal facets only for the meso- and ectocuneiforms; the ecto- and entocuneiforms are longer and narrower than in the latter. The shape of the navicular and entocuneiform make it clear that at least one large tibial sesamoid was present.

The metatarsus consists of five members. Metatarsal I is extremely slender and is relatively much more reduced than in *Steiromys*, not being more than half as long as II; it is, however, provided with a complete distal trochlea and evidently carried phalanges. Metatarsals II, III and IV are very slender and of nearly equal length, though they are so arranged as to make III project farthest distally, while IV is slightly shorter and heavier than the others; V is shorter than IV and has a well defined projection from the fibular side of the head, as in *Erethizon* and *Steiromys*.

The phalanges, so far as they are known, resemble those of the manus, except for their greater length and slenderness.

Relationships. — It is evident that *Sciamys* (and no doubt the same is true of the closely allied genus *Acaremys*) is related to *Steiromys* and perhaps referable to the same family, yet with such differences as are at least of subfamily rank. No existing genus can be derived from either of the genera of the *Acaremyinæ*, which were probably terrestrial animals that, in a measure, took the place of the rats and mice of the northern hemisphere. It is not unlikely that the invasion of the murines, which took place in the great migration from the north at the close of the Miocene, may have been the direct or indirect cause of the extinction of these small mouse-like and rat-like porcupines.

The species of *Sciamys* have been distinguished almost entirely in accordance with differences of size, but this is an untrustworthy criterion and needs to be supplemented by other characteristics.

SCIAMYS PRINCIPALIS Ameghino.

(Plates LXVI, Figs. 10–10^b; LXVII, 7–7^d.)

Sciamys principalis Amegh.; Enumeracion sistem., etc.; 1887, p. 9.

Among the skulls preserved in the various collections, the one which best agrees with the type of this species is characterized by its very narrow and gently tapering rostrum, a feature strikingly different from all the other skulls. As in most of the species of this genus, the incisors are very narrow and slender; in the mandible they have plane faces, but in the upper jaw they are slightly convex.

The nasals are long, narrow and of nearly uniform width, contracting slightly in the middle, and anteriorly are strongly convex; the free ends are rounded and entire, with a deep notch between nasals and premaxillaries. The latter are long and narrow, but of relatively large dorso-ventral height; between the alveolus of the incisor and the nasal is a thin, triangular plate of bone, which is unusually large in this species. The postorbital process of the frontal is but feebly developed.

The following dimensions are taken from No. 15,623:

Measurements.

Upper dentition, length	.022	Lower incisor, width	.0015
" " " p^4–m^3	.009	" " thickness	.002
Upper incisor, width	.0015	Rostrum, length	.015
" " thickness	.0025	" width at base	.008
Lower dentition, length	.020	" " " anterior end	.006
" " " p_4–m_3	.0085	" dorso-ventral height	.010

Sciamys varians Ameghino.

(Plate LXVII, Figs. 5–5^b, 9.)

Sciamys varians Amegh.; Enumeracion sistem., etc.; 1887, p. 9.

This name may be applied to those skulls which approximate or equal the preceding species in size, but differ from it decidedly in the shape of the rostrum, which is broader, especially at the base, and more tapering anteriorly, while the nasals are quite flat; the interorbital region also is wider than in *S. principalis* and there appears to have been no postorbital process.

The incisors are relatively narrower than in any other species of the genus and in the upper jaw they have quite plane anterior faces, which may or may not be marked by a very faint, hair-like groove.

The remains of the skeleton, other than the skull, which may be referred to this species belong to a single individual (No. 15,168) and consist of the cranium, mandible, two caudal vertebræ, parts of the humerus, ulna, femur, the tibia, calcaneum, astragulus, metatarsal III and certain phalanges of the pes. The description of the bones has already been given in connection with the account of the genus, but attention should be called to the relatively great length of metatarsal III, which exceeds that of *S. latidens*. In the subjoined table the dimensions of the upper teeth and skull are from No. 15,575, the others from No. 15,168.

MEASUREMENTS.

Upper dentition, length	.022	Ulna, width at sigmoid notch	.0025
“ “ “ $p_{\overline{4}}$–$m_{\overline{3}}$	.008	Femur, estimated length	.036
Upper incisor, width	.001	“ proximal width	.0075
“ “ thickness	.0027	“ distal width	.006
Lower dentition, length	.017	Tibia, length	.038
“ “ “ $p_{\overline{4}}$–$m_{\overline{3}}$	.008	“ distal width	.003
Lower incisor, width	.0012	“ “ thickness	.003
“ “ thickness	.002	Calcaneum, estimated length	.009
Rostrum, length	.013	Astragalus, length	.0055
“ width at base	.011	“ width of trochlea	.003
“ “ “ anterior end	.006	Metatarsal III, length	.015
“ dorso-ventral height	.010	“ “ proximal width	.002
Humerus, width of distal end	.006	“ “ distal width	.002
“ “ “ trochlea	.0035		

SCIAMYS ROSTRATUS sp. nov.

(Plate LXVII, Figs, 6–6^b.)

This species is intermediate in character between *S. principalis* and *S. varians.* The upper incisors have slightly convex and faintly grooved faces and are somewhat broader than in *S. varians.* The rostrum is more slender than in *S. varians*, less so than in *S. principalis.* Compared with those of the latter, the nasals are less convex and narrow more posteriorly, giving a broader dorsal surface to the ascending rami of the premaxillaries. The frontals have no postorbital processes. The type is No. 15,257 of the Princeton collection.

MEASUREMENTS.

Upper dentition, length	.0225	Rostrum, length	.012
“ “ “ $p^{\underline{4}}$–$m^{\underline{3}}$	.008	“ width at base	.010
Upper incisor, width	.0015	“ “ “ anterior end	.0065
“ “ thickness	.003	“ dorso-ventral height	.0085

SCIAMYS TENUISSIMUS Ameghino.

Sciamys tenuissimus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 68.

This is much the smallest known representative of the genus and may be easily distinguished by its minute size. So far, it is known only from mandibles, which differ from those of the larger species in the more posterior position of the ascending ramus, leaving all the grinding teeth exposed in side view; so much of the masseteric fossa as is preserved, indicates that it was relatively small.

MEASUREMENTS.

Lower dentition, length	.012	Lower incisor, thickness	.0015
" " " $p^{\underline{4}}$–$m^{\underline{3}}$	.005	Mandible, depth below $p_{\overline{4}}$	.004
Lower incisor, width	.0005		

SCIAMYS LATIDENS sp. nov.

(Plate LXVII, Figs. 1–3.)

The type of the species (Princeton collection, No. 15,944) is the most complete individual of the genus yet obtained. It consists of the skull, lacking the occiput and basis cranii, mandible, five cervical and several thoracic vertebræ, the sacrum and the greater part of the manus, tibia, fibula and pes. Collected by Messrs. Hatcher and Peterson at Killik Aike.

In skull and dentition *S. latidens* stands well apart from the other species of the genus and forms a transition to *Acaremys*, to which it would be referable, were it not for the character of the lower incisors. The upper incisors are quite broad, in marked contrast to the slender, delicate teeth found in most of the other species of *Sciamys*, and have distinctly convex faces, as much so as in *Acaremys murinus*, while the lower incisors are plane and are also broader than in the various preceding species, from which they further differ in the presence of a raised enamel border along the outer margin of the front face. The upper premolar is somewhat reduced in size, making the difference between this tooth and $m^{\underline{1}}$ unusually great, while $m_{\overline{3}}$ is conspicuously smaller than in the other species.

The skull is characterized by the broad and heavy rostrum with nearly parallel sides, and by the wide, nearly plane interorbital region; the frontals have distinct postorbital processes, a difference from the other species; the anterior border of the frontals is excavated in a broad, semicircular notch, to receive the nasals and premaxillæ. The nasals, which are rather short, are narrowest posteriorly, broadening gradually forward; their posterior half is nearly plane, the anterior portion moderately convex. The antero-superior angle of the premaxilla, between the incisor alveolus and the nasal, is very small, much smaller than in *S. principalis*. The palate is somewhat broader in front than behind, and the difference is rather more marked than in the other species.

The mandible does not exceed that of *S. principalis* in length, but is heavier, and the inferior margin of the angle is unusually broad, owing to the development of the masseteric and pterygoid crests.

The parts of the skeleton have already been described in the account of the genus. The tibia, which seems to have been of nearly the same length as in *S. varians*, has a somewhat heavier distal end, while the median metatarsal is notably shorter than in that species.

MEASUREMENTS.

Upper dentition, length	.023	Digit IV, phalanx 1, length	.004
" " " p^4–m^3	.0075	" " " 2, "	.002
Upper incisor, width	.002	" " " 3, "	.005
" " thickness	.003	Tibia, distal width	.0035
Skull, interorbital width	.045	" " thickness	.003
Rostrum, length	.012	Calcaneum, length	.009
" width at base	.011	Astragalus, length	.0055
" width at anterior end	.0085	" width of trochlea	.003
" dorso-ventral height	.0085	Metatarsal I, length	.0065
Lower dentition, length	.020	" " proximal width	.0013
" " " p_4–m_3	.008	" " distal width	.0013
Lower incisor, width	.002	Metatarsal II, length	.013
" " thickness	.003	" " proximal width	.0015
Diastema, length	.008	" " distal width	.002
Mandible, depth below p_4	.007	Metatarsal III, length	.0125
Metacarpal II, length	.007	" " proximal width	.002
" " proximal width	.0015	" " distal width	.002
" " distal width	.0017	Metatarsal IV, length	.012
Metacarpal III, length	.075	" " proximal width	.0015
" " proximal width	.002	" " distal width	.002
" " distal width	.002	Metatarsal V, length	.010
Metacarpal IV, length	.0065	" " proximal width	.0025
Digit IV, length	.0165	" " distal width	.002

SCIAMYS ROBUSTUS Ameghino.

Sciamys robustus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 68.

This incompletely known species differs from the others in such a way as to suggest that better material may require its generic separation. In the Princeton collection it is represented only by one specimen (No. 15,824) consisting of the symphysial region of a mandible, with both incisors in place, and retaining the alveolus of p_4, together with some fragments of limb bones. *S. robustus* is the largest known species of the genus, and the incisors are of somewhat uncommon proportions, the thickness not exceeding the width so much as usual, and each one is marked by a groove, shallow and inconspicuous and yet quite distinct; the mesial border is raised into a fine, almost hair-like ridge, while the outer border is a wider and more distinct ridge.

MEASUREMENTS.

Lower incisor, width	.002	Diastema, length	.0115
" " thickness	.0025		

ACAREMYS Ameghino.

(Plates LXVI, Figs. 11, 11^a; LXVII, 4–4^b, 10–13.

Acaremys Amegh.; Enumeracion sistem., etc.; 1887, p. 9.

Closely allied to *Sciamys*, though not so well known, because it is much less abundantly represented in the collections. The grinding teeth have the same pattern as in *Sciamys*, but the incisors, both upper and lower, have convex faces and, in most of the species, are quite broad. The skull also resembles that of *Sciamys*, with a few differences of detail, which appear to be constant. The dorsal branch of the maxillary zygomatic process is much more slender; except in *A. minutus*, which has a process from the jugal, the frontal has a short postorbital process, which projects more abruptly than in those species of *Sciamys* which have the process. In the parietal zone *Acaremys* has a distinct sagittal crest, which is not the case in *Sciamys*. No part of the skeleton other than the skull has yet been found.

ACAREMYS MURINUS Ameghino.

(Plates LXVI, Figs, 11, 11^a; LXVII, 4–4^b, 12.)

Acaremys murinus Amegh.; Enumeracion sistem., etc.; 1887, p. 9.
Acaremys messor Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent.; 1889, p. 126.

This species may be distinguished by its broad and blunt rostrum, almost without anterior taper. To it I refer a specimen in the American Museum of Natural History (No. 9,280) which unfortunately, has no mandible associated with it and may possibly belong to *Sciamys latidens*, which it closely resembles, but the upper incisors are broader and more strongly convex, while the part protruded from the alveolus is much longer and the abraded surface much more gently inclined; the rostrum has more nearly parallel sides and the anterior end is blunter; the upper contour of the facial region is straighter, the nasals are narrower behind, broadening more anteriorly, where they are even less convex; the post-orbital process of the frontal projects more abruptly; the incisive foramina are larger and the posterior nares of a different shape.

The specimens described as *A. messor* are apparently somewhat larger and more robust individuals of the present species.

MEASUREMENTS.

Upper dentition, length	.0245	Rostrum, length	.014
" " " p^{4}–m^{3}	.0075	" width at base	.012
Upper incisor, width	.0025	" " " anterior end	.009
" " thickness	.0032	" dorso-ventral height	.0095
Skull, interorbital width	.0105		

ACAREMYS KARAIKENSIS Ameghino.

Acaremys karaikensis Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 299.

Though originally separated from *A. murinus* on account of its larger size, the transitions in this respect are so complete, that the species cannot be maintained for that reason alone. However, the validity of the species is evident from the character of the incisors, which are narrower than in the preceding species, and from the shape of the rostrum, which is broad at the base and tapers forward rapidly.

ACAREMYS MAJOR sp. nov.

The type specimen (No. 15,366), a skull without mandible and considerably distorted by pressure, was collected at Killik Aike by Mr. O. A. Peterson. It is so much larger than any other known representative of the genus that it probably represents a distinct species. Though the skull markedly exceeds that of *A. murinus* in size, the incisors are actually narrower, while the grinding teeth are notably larger, especially in width, and are of different relative sizes, p^{4} and m^{1} being nearly equal, while m^{2} and ^{3} are considerably larger; m^{3} is not at all reduced, as it is in *A. murinus.* The rostrum is long, narrowing forward somewhat, but quite broad, even anteriorly.

MEASUREMENTS.

Upper dentition, length	.030	Skull, interorbital width	.017
" " " p^{4}–m^{3}	.0085	Rostrum, length	.020
Upper incisor, width	.002	" width at base	.014
" " thickness	.003	" " " anterior end	.0085
Skull, length	.057	" dorso-ventral height	.010

ACAREMYS MINUTUS Ameghino.

(Plate LXVII, Figs. 10–10^{c}, 13.)

Acaremys minutus Amegh.; Enumeracion sistem., etc.; 1887, p. 9.

This species is smaller and more delicate in all its proportions than *A. murinus* and in a number of respects its skull is very characteristic. The incisors are narrow and slender, with strongly convex faces, and the grinding teeth are very small; p^{4} and m^{3} are slightly smaller than m^{1} and ^{2}, but m^{3} is relatively less reduced than in *A. murinus*. The upper incisors are less strongly curved than in any of the other species of this genus, or *Sciamys*, so that the alveoli do not extend so near to the dorsal border of the premaxillaries, leaving a wider, thin and plate-like strip between the alveolus and the nasal suture and giving quite a characteristic appearance to the rostrum. The latter is rather slender and tapers anteriorly, though not in any marked degree. The frontals are nearly plane, with prominent supraorbital ridges, but with no definite postorbital processes (Fig. 10, Pl. LXVII, is erroneous in this respect). On the other hand, the jugal has a distinct postorbital angulation; anteriorly the jugal ends in a point, not ascending the zygomatic process of the maxillary, and posteriorly it is continued to the glenoid cavity. As in the other species of this genus, the dorsal branch of the maxillary zygomatic process is quite slender, but its broad side is turned more obliquely forward and less laterally. A peculiarity of *A. minutus* is the shape of the posterior nares, the front wall of which slopes ventrally and forward, forming a narrow, sharply pointed, V-shaped depression in the palate, which extends almost to m^{2}.

MEASUREMENTS.

Upper dentition, length	.019	Rostrum, length	.0125
" " p^{4}–m^{3}	.007	" width at base	.0085
Upper incisor, width	.0015	" " " anterior end	.006
" " thickness	.0023	" dorso-ventral height	.008
Skull, interorbital width	.0085		

An isolated mandible has the following dimensions:

Lower dentition, length	.0165	Lower incisor, width	.0015
" " p$_{4}$–m$_{3}$	.008	" " thickness	.002

Acaremys minutissimus Ameghino.

(Plate LXVII, Figs. 11, 11^a.)

Acaremys minutissimus Amegh.; Enumeracion sistem., etc.; 1887, p. 9.

This is the smallest rodent yet discovered in the Santa Cruz beds, being decidedly smaller than *Sciamys tenuissimus*, from which it may be distinguished not only by the convex faces of the lower incisors, but also by the form of the mandible, the ascending ramus rising more anteriorly and externally, leaving a wider space between itself and the teeth.

A specimen in the Princeton collection is even smaller than the type, in which the lower grinding series measures 5.5 mm. in length and the depth of the jaw below $\mathrm{p}_{\overline{4}}$ is 4 mm.

Measurements.

Lower dentition, length	.010	Lower incisor, width	.0005
" " " $\mathrm{p}_{\overline{4}}$–$\mathrm{m}_{\overline{3}}$	.005	" " thickness	.001
" " " $\mathrm{p}_{\overline{4}}$–$\mathrm{m}_{\overline{2}}$	.004	Mandible, depth below $\mathrm{p}_{\overline{4}}$	.0033

Acaremys tricarinatus Ameghino.

Acaremys tricarinatus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 68.

Known only from the type specimen. In all of the preceding species of *Acaremys* $\mathrm{p}_{\overline{4}}$ is of the same pattern as the molars, but in the present species it is more complex, having two external enamel folds, instead of only one, thus producing three external crests. Size as in *A. murinus*.

I am not entirely satisfied that this species is not founded upon a young individual of the last-named species with $\mathrm{dp}_{\overline{4}}$ still in use.

CHINCHILLIDÆ.

PERIMYS Ameghino.

(Plate LXVIII, Figs. 1–15.)

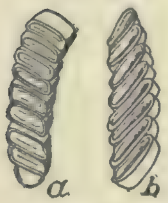
Perimys Amegh.; Enumeracion sistem, etc.; 1887, p. 12.

Sphiggomys Amegh.; Ibid.

This genus is abundantly represented in the Santa Cruz beds and includes a surprising number of species, which, in size, range from very small animals to the largest rodents yet found in the formation.

The diagnostic features of the genus are to be found in the dentition, which has a general resemblance to that of the recent *Viscaccia* (*Lagostomus*), but with well marked and characteristic differences. The incisors have plane faces and, in comparison with the size of the animal, they are quite slender and short, the upper ones extending but a little distance into the maxillaries; the lower incisors are longer and extend along the inner side of the mandible to a distance which differs in the various species, but never reaching behind the molar series. The grinding teeth are entirely rootless and are composed of obliquely transverse laminæ, much as in *Viscaccia*, with the difference that the laminæ are not in contact, but separated by a valley which, at least in the larger species, is filled with cement; the valleys open outward in the lower teeth and the upper premolar, inward in the upper molars. In the lower teeth the laminæ are connected on the inner side by a narrow bridge of enamel, and on the outer side in the upper molars, while in the upper premolar both enamel and dentine are continued around the inner end of the valley, so that this tooth has quite a different appearance from any of the others. The third upper molar also differs from all the other grinding teeth in having three transverse laminæ and two valleys, the posterior lamina being shorter and more pyriform than the others. In both jaws the two series of teeth converge strongly forward.

FIG. 40.

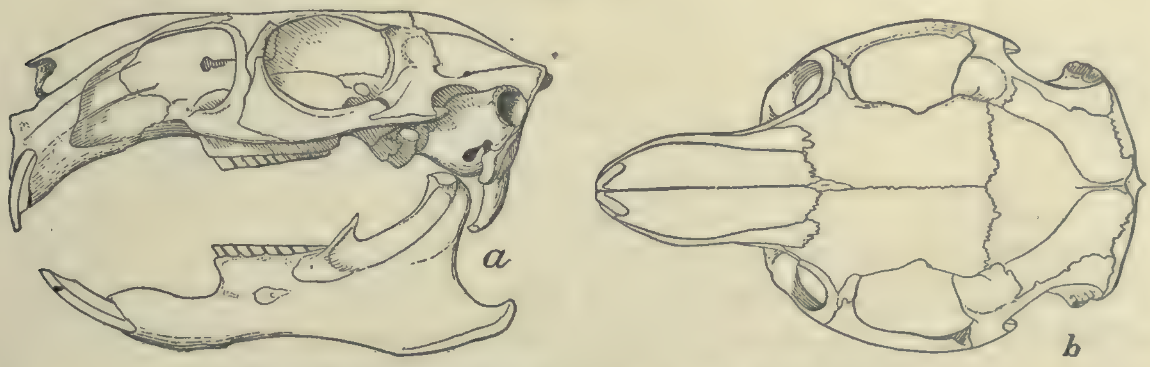


Grinding teeth of *Viscaccia chilensis*. Crown view, × $\frac{1}{1}$. *a*. Right upper teeth. *b*. Right lower teeth.

The skull is much like that of *Viscaccia* in its general proportions and in the shape and connections of its various elements, but there are certain not unimportant differences. The occiput is broad and low, with nearly the same relative height and width as in *Viscaccia*, but the bones are thicker and the occiput is not plane, but has a marked median convexity, with a prominent vertical ridge; there is no such median fontanelle as is found in the modern genus; the foramen magnum is of a more transversely oval shape and the condyles are somewhat larger. In none of the specimens are the paroccipital processes preserved entire, but it is evident that they were much shorter than in *Viscaccia*, though better developed than in the other recent genera of the family. The supraoccipital has a somewhat broader surface on the dorsal side of the cranium than in *Viscaccia* and the occipital crest is correspondingly thicker; as in the latter, the bone has long lateral processes, which extend down over the periotics, but are widely separated from the mastoid processes. In the large species of *Perimys* the periotic is exposed on the occipital surface, though less extensively than in *Viscaccia*, while in some, at least, of the small species, it appears only in a narrow fossa between the exoccipital and squamosal; on the other hand, it is never visible on the cranial roof, as it so conspicuously is in *Chinchilla* and *Lagidium*. The periotic is also smaller than in any of the three recent genera; the mastoid process is quite well developed. The tympanic is larger than in *Viscaccia* and thus the auditory bulla has quite a different appearance, and the meatus is a short tube, which, compared with that of the latter genus, is directed more upward and outward, less backward.

The parietals are relatively longer than in *Viscaccia* and support a more distinct sagittal crest, from which quite prominent temporal ridges diverge.

FIG. 41.



Skull of *Viscaccia chilensis*, × $\frac{1}{2}$. *a.* Left side. *b.* Top.

The frontals are broad and have a vaulted, convex surface, due to the large sinuses; this inflated appearance of the forehead is more marked in the larger species of the genus. The supraorbital ridge is prominent and the postorbital process is much better developed than in *Viscaccia* and the notch in front of it is correspondingly deeper; in the modern genus a small, separate bone is placed between the anterior ends of the frontals, but I have not observed this in *Perimys*. The squamosal has a somewhat broader supramastoid process than in *Viscaccia*, but it is of quite a similar shape; between the anterior end of this process and the periotic is a narrow, oval foramen, which is larger than in *Viscaccia*, but far smaller than in *Chinchilla* or *Lagidium*. The jugal also is much as in *Viscaccia*, extending behind to the glenoid cavity, and in front apparently rising to a contact with the lachrymal. The dorsal branch of the maxillary zygomatic process is very broad, making the outer wall of the infraorbital foramen far wider than in the recent genus.

The nasals have much the same foliate shape as in *Viscaccia*, but in their anterior half these bones are much less convex and have no such inflated appearance; while the free ends are bluntly pointed and not notched, but are separated for a considerable distance from the premaxillaries. The latter are very similar to those of the recent genus, but the masseteric fossa is shallower and of a different shape; the ascending rami are long, extending over the maxillaries to a suture with the frontals, the shape of which varies in the different species. The hard palate is of triangular shape, narrowing forward; much of it is formed by the palatines, which have a smooth, dense surface, in marked contrast to the almost lace-like texture of the maxillary palatine processes; the maxillary portion of the palate is less concave than in *Viscaccia* and the median ridge is lower, while the ventral surface of the palatine bones is broader. The posterior nares are considerably smaller than in the modern genus and there is no such median spine from the front border. The pterygoid fossæ are large and are so perforated as to be in communication with the orbits.

The mandible is very much like that of *Viscaccia*, with certain significant differences; the condyle is narrower and more elongate antero-posteriorly; the coronoid, though very small, is much less reduced, rising nearly as high as the condyle, from which it is separated by a far narrower and shallower sigmoid notch. The masseteric fossa is very deep and has quite the same elevated position on the ascending ramus as in the modern genus, but is considerably larger; the masseteric crest, which in the existing genera of the family is almost obsolete, in *Perimys* is very prominent, especially in the dentary region of the jaw, becoming less distinct posteriorly; the pterygoid crest also is better developed, making the angle more concave on the inner side and giving it a much wider ventral margin. The symphysial region of the jaw is less procumbent and the chin rises more steeply from the ventral border of the horizontal ramus than in the existing genera.

Unfortunately, little is known of the skeleton, other than the skull, but enough remains to show that there are certain not unimportant differences from all of the recent genera of the family. The parts to be described are all from the quite small species, *P. scalaris* and *P. puellus*. The cervical vertebræ are relatively somewhat heavier than in *Viscaccia* and the axis has a broader spine; in the trunk the anterior thoracic vertebræ are larger and the lumbars smaller; evidently the back was not so strongly arched as in the recent genus, for there is no such disproportion in the relative length of the fore and hind limbs as characterizes the latter, the fore limbs being longer and heavier and the hind limbs shorter and more slender proportionally.

The scapula has a slender neck and a rather broad, triangular blade, which, so far as can be determined, is not unlike that of *Viscaccia* in shape. The humerus, the proximal end of which has not been found, resembles that of the modern genus, but the deltoid crest is even more prominent and rises more abruptly from the shaft; the distal end is narrower and the internal epicondyle is less prominent; there is no epicondylar foramen, but a large supratrochlear perforation, and the supinator ridge is but feebly developed; the trochlea, which is rather narrow, has a prominent internal flange for the ulna and three facets for the radius, a median convexity, with slightly concave surfaces on each side of it.

The fore-arm bones are slender and elongate, with decided forward curvature. The ulna, no specimen of which with complete olecranon has yet been found, has a prominent coronoid process and anteriorly has only a narrow facet for the humeral trochlea, nearly the whole width of which is occupied by the radius; the shaft is slender, laterally compressed and, on the outer side, is conspicuously channelled for most of its length, and the distal end is contracted to a narrow, convex facet for the pyramidal. The radius has a broad proximal end, with three facets for those on the humeral trochlea; the shaft, which proximally is of a transversely oval section, for most of its length is of subtrihedral shape, much as in *Viscaccia;* the distal end is unknown. Of the manus only metacarpal V has been found; this is very small, though relatively larger than in the recent genus, and is of similar shape, except that the distal end is less expanded.

The only known example of the femur has lost the proximal epiphysis and is otherwise damaged, but its length may be determined with sufficient accuracy to show that its proportions were very different from those of the femur of *Viscaccia*, being relatively much shorter and more slender. The small patella is of nearly uniform width; proximally it is quite thick, thinning nearly to an edge at the distal end; the surface for the femoral trochlea is decidedly convex transversely, very slightly concave longitudinally. The tibia also is relatively much shorter and more slender than in *Viscaccia*, in which the tibia is nearly twice as long as the radius, while in *Perimys* it is only about one third longer; the proximal portion is thick, owing to the development of the cnemial crest, but for most of its length, the shft is aslender and subcylindrical.

The calcaneum has a short, straight and heavy tuber, with parallel dorsal and ventral borders, and an elongate distal portion, ending in an oblique, concave facet for the cuboid. The trochlea of the astragalus is narrow and deeply grooved and the relatively long neck has but little inclination to the tibial side; the head is rather thick planto-dorsally. The number of digits in the pes is not known, but it was quite certainly not less than four and may have been five. The metatarsals are considerably longer than the metacarpals, but they are very slender and evidently the hind foot was shorter and far more slender than in *Viscaccia.*

Relationships. — Imperfect as are the known specimens of *Perimys*, they suffice to prove the close relationship of the genus to *Viscaccia* and the propriety of including it in the *Chinchillidæ.* Not improbably it is but little removed from the common ancestor of all the existing genera of that family, for the genus is known from formations older than the Santa Cruz. On the other hand, the Santa Cruz species are without phylogenetic significance and represent a branch of the family which, though flourishing at that period, soon became extinct and did not persist to the later epochs.

The numerous species into which Ameghino has divided *Perimys* require revision, but the material is still too incomplete for any satisfactory performance of this task. The Princeton and New York collections contain several individuals which, though approximating Ameghino's types, do not agree at all closely with them; it will therefore be necessary either to regard most of the species as variable groups, or else to increase their number very considerably.

Disregarding size, the species of *Perimys* fall naturally into two series, though transitions between them occur, distinguished by the character of $p_{\overline{4}}$; in one series $p_{\overline{4}}$ is not very oblique, its postero-internal portion is not very strongly compressed, and the valley opens externally; in the other series $p_{\overline{4}}$ has a very oblique position, so that the valley opens anteriorly rather than laterally, and the postero-internal end is very narrow and compressed. As the mandibular dentition of several species is not known, this distinction cannot be made in a consistent manner.

PERIMYS ERUTUS Ameghino.

(Plate LXVIII, Figs. 5, 13.)

Perimys erutus Amegh.; Enumeracion sistem., etc.; 1887, p. 12.

The typical and most abundant species and of quite small size, though by no means the smallest of the genus. The upper incisors are slender and have moderately convex faces; the grinding teeth are relatively narrow and in $m^{\underline{1}}$ the anterior lamina projects so as to form an external pillar, the prominence of which varies considerably; the other molars have no such pillar. The two dental series converge anteriorly, but less strongly than in certain other species. In the mandible $p_{\overline{4}}$ is but moderately compressed on the inner side and the valley opens almost laterally; only in $m_{\overline{3}}$ is an internal pillar formed by the projection of the posterior lamina beyond the anterior one.

The occiput is low and wide, the breadth considerably exceeding the dorso-ventral height; the periotic seems to be excluded from the occipital surface and to be exposed only in a narrow fossa between the squamosal and exoccipital. The tympanic element of the auditory bulla is very largely inflated and closely appressed to the basioccipital, leaving but a narrow slit for the foramen lacerum posterius; the posterior nares are narrow and the palatines are relatively broad. The rostrum is slender and elongate, somewhat constricted at the base and slightly enlarged at the maxillo-premaxillary suture.

MEASUREMENTS.

Upper dentition, length	.035
" " " $p^{\underline{4}}$–$m^{\underline{3}}$	.014
Upper incisor, width	.002
" " thickness	.0023
$M^{\underline{1}}$, length (*i. e.*, antero-posterior diameter)	.003
$M^{\underline{1}}$, width (*i. e.*, transverse diameter)	.0035
$M^{\underline{2}}$, length	.005
" width	.0033
Skull, length	.059
Occiput, height	.014
Occiput width at base	.021
Tympanic bulla, antero-posterior diameter	.011
Zygomatic arch, length	.028
Palate, length to base of rostrum	.015
" width at $p^{\underline{4}}$	.003
" " " $m^{\underline{3}}$	.010
Rostrum, length	.017
" width at base	.008
" " " anterior end	.007

PERIMYS PROCERUS Ameghino.

(Plate LXVIII, Fig. 7.)

Perimys procerus Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent.; 1889, p. 172.

To this species I refer an incomplete skull in the collection of the American Museum of Natural History (No. 9,507) which agrees well with the type. In size and appearance this species is very near to the preceding one, but the differences are characteristic and constant. The upper incisors, which have plane and not convex faces, have slightly different proportions, the width and thickness being almost exactly equal. The grinding teeth are distinctly wider than in the preceding species, the two upper series have a stronger anterior convergence, and the external pillar of $m^{\underline{1}}$ is exceedingly small or absent. The hard palate is wider behind, narrower in front than in *P. erutus*, but the posterior nares are also wider and the palatines narrower. The rostrum has nearly the same proportions as in the latter species; the ascending ramus of the premaxilla forms a narrow strip on the dorsal side of the rostrum, extending a little behind the nasals; the latter do not contract posteriorly and their hinder portion is concave, not flat; the forehead is much less convex and inflated than in the larger species.

MEASUREMENTS.

Upper dentition, length	.035	Zygomatic arch, length	.031
" " " $p^{\underline{4}}$–$m^{\underline{2}}$	.015	Palate, length to base of rostrum	.013
Upper incisor, width	.0023	" width at $p^{\underline{4}}$	.0025
" " thickness	.0023	" " " $m^{\underline{2}}$	.012
$M^{\underline{1}}$, length (*i. e.* antero-posterior diameter)	.003	Rostrum, length	.013
$M^{\underline{1}}$, width (*i. e.* transverse diameter)	.004	" width at base	.0085
$M^{\underline{2}}$, length	.0055	" " " anterior end	.007
" width	.004	" dorso-ventral height	.012

PERIMYS SCALARIS Ameghino.

(Plate LXVIII, Fig. 14.)

Perimys scalaris Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 301.

The type is a palate with all the grinding teeth in place; it represents an animal somewhat smaller than *P. erutus*, from which it is distinguished by the prominent external pillar on all the upper molars. In the large species of the genus the pillars of both upper and lower teeth are very variable, but in *P. scalaris* and certain other small species they appear to be quite constant.

To the same species I refer a very young animal in the Princeton collection (No. 15,063), in which $p_{\overline{4}}$ has just been erupted and shows no signs of wear; the specimen consists of the greater part of a skeleton, unfortunately in a very much damaged condition. The lower incisors, which protrude but little above the alveoli, are narrow and have slightly convex faces, which are faintly grooved. In its unworn state, p_4 appears to have two valleys, one of which is the true valley and the other is a deep notch, demarcating the internal pillar, which is very prominent; all the lower molars likewise have well marked internal pillars, produced by the projection of the posterior lamina. Of the skull, only the tympanic bullæ and the mandible are preserved; the bullæ are relatively very large, and the horizontal ramus is long, low and thick, and the much damaged angle ends in a very long process, which extends behind the bulla. Most of the limb-bones have lost their epiphyses, so that it is not practicable to give their dimensions, save in a few instances. A description of these bones, parts of the scapula, ulna, metacarpal III, femur, tibia, calcaneum and astragalus has been given in the account of the genus.

In the following table the measurements of the upper teeth are from the type in the Ameghino collection, the others are from No. 15,063.

MEASUREMENTS.

Upper dentition, length p^4–m^2	.012
M^1, length (*i. e.*, antero-posterior diameter)	.002
M^1, width (*i. e.*, transverse diameter)	.0035
M^2, length	.004
" width	.0035
Lower dentition, length	.025
" " " p_4–m_3	.013
Lower incisor, width	.002
" " thickness	.002
M_1, length	.003
" width	.003
M_3, length	.003
M_3, width	.003
Mandible, depth at p_4	.008
" " " notch in front of p_4	.005
Mandible, thickness at p_4	.0065
Scapula, height (approximate)	.032
" width of neck	.004
Ulna, width at sigmoid notch	.004
Metacarpal III, proximal width	.0025
Tibia, length	.044
" distal width	.006
" " thickness	.005
Astragalus, length	.008
" width of trochlea	.005

PERIMYS PERPINGUIS Ameghino.

(Plate LXVIII, Figs. 11, 12.)

Perimys perpinguis Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 144.

A species of medium size, larger than any of the preceding ones, but much smaller than others; the type is a fragment of mandible with

m_{1-3} in place. It is evident from the shape of the empty alveolus that p_4 was much compressed and very narrow in the inner side, yet the valley apparently opened laterally, not anteriorly; on all of the lower molars the internal pillar is strong.

To the same species I refer a palate, with all the grinding teeth in place, in the Princeton collection (No. 15,227), which is from a slightly larger animal than the type. This specimen is remarkable for the large size of p^4, which projects externally beyond the line of the molars and gives a decided curvature to the outer line of the dental series, a curvature which is more marked than in the larger species; m^1 and ^{2} have antero-external pillars.

In the table the dimensions of the upper jaw and teeth are from No. 15,227, the length of the lower grinding series is from the type in the Ameghino collection.

MEASUREMENTS.

Upper dentition, length p^4–m^3	.0215	M^3, length	.0075
P^4, length (*i. e.*, antero-posterior diameter)	.005	" width	.005
P^4, width (*i. e.*, transverse diameter)	.0065	Palate, width at p^4	.004
M^1, length	.004	" " " m^3	.022
" width	.005	Lower dentition, length p_4–m_3	.020

Ameghino has described three large species of *Perimys*, distinguishing them by the development of the pillars, but, as already mentioned, these pillars are very variable in the large species, and in the same jaw a given tooth on one side may have a prominent pillar and on the other side be without a trace of it. Nevertheless, the three species may be distinguished upon other grounds and are probably valid; at all events, it would be premature to unite them.

PERIMYS ONUSTUS Ameghino.

(Plate LXVIII, Figs. 3, 3^a.)

Perimys onustus Amegh.; Enumeracion sistem., etc.; 1887, p. 12.

This name may be applied to the somewhat smaller individuals, in which the incisors are narrow and the mandible relatively slender. The specimen which best agrees with the type is a right mandibular ramus (No. 15,230) especially characterized by its slenderness, which, in turn, is due to the relatively low-crowned teeth. The lower incisor is narrow and plane; posteriorly its alveolus forms a marked protuberance on the inner side of the jaw, extending nearly to $m_{\overline{4}}$. On $p_{\overline{4}}$, the internal pillar is very faintly marked; indeed, in this individual, the pillar is well developed only on $m_{\overline{3}}$, though it is fairly distinct on $m_{\overline{2}}$ also. The horizontal ramus of the mandible is shallow and slender and the symphysial region is comparatively narrow.

In the Ameghino collection is a very fine skull with mandible, which is referred to *P. onustus*, but the incisors are so much heavier than in the individual here described that it probably belongs to a different and perhaps undescribed species.

MEASUREMENTS.

Lower dentition, length	.051	$P_{\overline{4}}$, width (*i. e.*, transverse diameter)	.0055
" " " $p_{\overline{4}}$–$m_{\overline{3}}$	.025	$M_{\overline{3}}$, length	.008
Lower incisor, width	.0032	" width	.006
" " thickness	.0033	Mandible, depth at $p_{\overline{4}}$	.0115
$P_{\overline{4}}$, length (*i. e.*, antero-posterior diameter)	.006	" " " notch in front of $p_{\overline{4}}$	.0075

PERIMYS IMPACTUS Ameghino.

(Plate LXVIII, Figs. 1, 1*a*, 2, 2*a*, 9, 9*a*.)

Perimys impactus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 72.

This species is not only larger than *P. onustus*, but is also of relatively more robust and massive character. The incisors are considerably heavier than in the latter and have more convex faces; the upper premolar is large, projecting outside of the other teeth and giving a sigmoid curvature to the external line of the dental series; the upper molars normally have the antero-external pillar. The lower premolar is much contracted on the inner side and an internal pillar seems to be constantly present, but varies much in size; in one individual (Plate LXVII, fig. 9*a*), for example, it is not observable in the grinding surface, though plainly visible from the inner side; some individuals have a second pillar near the antero-external border. On the lower molars also the pillar is variable; it is constantly present in $m_{\overline{3}}$ and has not been observed on $m_{\overline{1}}$, while on $m_{\overline{2}}$ it may be large and conspicuous, small, or entirely absent.

The skull (Pl. LXVIII, figs. 1, 1*a*) is very large; it bears considerable resemblance to that of *Viscaccia*, but is actually much longer and relatively narrower. The occiput is higher and not so broad and the periotic is less extensively exposed upon the occipital surface, though much more so than in the small species of *Perimys*. The sagittal crest and temporal ridges are more prominent and the parietals on each side of the crest are more concave than in *Viscaccia;* the tympanics are more largely inflated and more spheroidal in shape, and are not suturally connected with the pterygoids. The forehead is more convex than in the small species of the genus, owing to the large development of the frontal sinuses, and the postorbital processes are long and prominent. The posterior nares are relatively broad.

The mandible differs from that of *P. onustus* in the much greater depth and thickness of the horizontal ramus and in the greater height of the alveolar border above the edentulous region. In one specimen (No. 15,697, Pl. LXVIII, figs. 2, 2^a) the jaw is unusually thick and massive and the masseteric crest is more prominent than in the other individuals; to some extent, this great thickness may be abnormal or even pathological.

Measurements.	Type.	*No. 15,881.*	*No. 15,053.*	*No. 15,697.*
Upper dentition, length $p^{\underline{4}}$–$m^{\underline{3}}$	.030	.028		
$P^{\underline{4}}$, length (*i. e.*, antero-posterior diameter)	.007			
“ width (*i. e.*, transverse diameter)	.0095			
$M^{\underline{3}}$, length	.009			
“ width	.006			
Lower dentition, length $p_{\overline{4}}$–$m_{\overline{3}}$	.028		.027	
$P_{\overline{4}}$, length	.0055		.007	.008
“ width	.007		.0065	.0075
$M_{\overline{3}}$, length	.0055		.0085	
“ width	.008		.007	
Occiput, height		.030		
“ width at base		.040		
Skull, width in interorbital region		.043		
Zygomatic arch, length		.052		
Palate, width at $p^{\underline{4}}$		.005		
“ “ “ $m^{\underline{3}}$		.018		
Mandible, depth at $p_{\overline{4}}$			.018	.017
“ “ “ notch in front of $p_{\overline{4}}$			.011	.013
“ thickness at $p_{\overline{4}}$			.013	.0145

PERIMYS AMEGHINOI sp. nov.

(Plate LXVIII, Fig. 10.)

Perimys zonatus Amegh., in part; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 72.

Under the name of *P. zonatus* Ameghino has, I believe, included two quite distinct species. The type of *P. zonatus* is remarkable for the obliquity of its teeth, while the specimen here considered and upon which the description given under the head of *P. impactus* was founded, seems to be very different. The description of *P. impactus* is as follows: "Size as in *P. onustus* and *P. zonatus;* distinguished by $p_{\overline{4}}$, $m_{\overline{2}}$ and $_{\overline{3}}$, which have an internal perpendicular column behind. In *P. onustus* this column is found only in $p_{\overline{4}}$ and $m_{\overline{3}}$; in *P. zonatus* it is present on all four molars" ('94^a, 72). *P. ameghinoi* is a very large species, quite equalling *P. impactus* in size; it is characterized by p_4, which hardly differs at all in shape from the lower molars, being much less contracted on the inner side than in the preceding species, and the valley opens more directly outward, less anteriorly. In the only known specimen all four of the lower grinding teeth have the internal column, but this may not be a constant character.

MEASUREMENTS.

Lower dentition, length $p_{\overline{4}}$–$m_{\overline{3}}$	.027	$P_{\overline{4}}$, width (*i. e.*, transverse diameter)...	.007
$P_{\overline{4}}$, length (*i. e.*, antero-posterior diameter)	.007	$M_{\overline{3}}$, length	.009
		" width	.006

In the second section of the genus, corresponding to *Sphiggomys*, the lower premolar is so turned as to have its major diameter almost coincident with the long axis of the jaw, the valley opening nearly or quite directly forward. Though the two groups of species are fairly well distinguished by this character, transitions between them do occur.

PERIMYS PUELLUS Ameghino.

(Plate LXVIII, Fig. 4.)

Sphiggomys puellus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 143.

Perimys puellus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 72.

In the Princeton collection this species is represented by a fairly complete skull, with mandible, associated with several cervical vertebræ and bones, more or less complete, of the fore leg and foot.

In size, this species does not greatly exceed *P. erutus*, but it differs considerably from the latter in its proportions. The upper incisors are not known; those of the lower jaw are rather broad and have perfectly plane faces, which are not grooved and but faintly striate. The upper premolar is quite large and its valley is rather more distinctly angulate than usual. The first and second upper molars have prominent external pillars, formed by the projection of the anterior lamina; in m^2 this pillar is very small and, on the right side, hardly noticeable. The lower premolar is not rotated quite so completely as in the type specimen and the valley does not open quite so directly forward, but the difference is not a marked one. The variability of the internal pillar of the lower grinding teeth is well illustrated by this individual; on the right side of the jaw $p_{\overline{4}}$ has this pillar distinctly, though not conspicuously, marked, while on the left side there is no trace of it; $m_{\overline{1}}$ has no pillar on either side, while on both sides $m_{\overline{2}}$ has a small and $m_{\overline{3}}$ a large one.

Except in size, the skull differs little from that of *P. erutus;* as in that species, the periotic is not exposed upon the occipital surface, but in a deep and narrow fossa between the squamosal and exoccipital; the occiput is considerably higher than in *P. erutus*, though the difference is, to some extent, due to the crushing which this specimen of *P. puellus* has undergone. On account of this crushing it is difficult to determine the length of the sagittal crest (which appears to be relatively longer than in *P. impactus*) and the degree of convexity of the forehead. One peculiarity is, however, quite distinct; namely, that the notch of the supraorbital border, in front of the postorbital process, is much better defined than in any other species in which this region of the skull is known. The foramen which lies above and in front of the auditory meatus, between the periotic and squamosal, is considerably larger and more conspicuous than in *P. erutus.* The tympanic bulla is very large, larger than in any other species with which I have been able to compare it.

The mandible has a high, but thin and laterally compressed, horizontal ramus, on the inner side of which the incisor alveolus forms a hardly noticeable protuberance, much less prominent than in the larger species of the genus. A characteristic feature of this mandible is the abrupt form of the notch in front of $p_{\overline{4}}$; forward of this notch the edentulous border rises to the level of the alveolar border, instead of sloping gently to the edge of the incisive alveoli (cf. fig. 4 with figs. 3 and 9, Pl. LXVIII). The masseteric crest is proportionately better developed and extends farther forward than in the larger species, and the pterygoid crest is also more prominent, making the ventral border of the angle wider and the inner side of the ramus more concave. The condyle resembles that of *Viscaccia*, except in being narrower, and the coronoid rises more nearly to the level of the condyle, though, owing to the shallowness of the sigmoid notch, its freely projecting portion is much shorter.

The cervical vertebræ indicate a longer neck, proportionately to the size of the head, than in *Viscaccia*. The atlas, which is broad and low, has a prominent hypapophysis, which is not present in the modern genus. The axis is broad in front, very narrow behind, with posterior face which is dorso-ventrally concave; so much of the broken neural spine as remains resembles that of the recent genus, except that it is less inclined backward. The other cervicals have oblique faces and the posterior face, as in the axis, is dorso-ventrally concave; on the third, fourth and fifth vertebræ, at least, the spine is obsolete.

It will be unnecessary to repeat here the description of the limb bones given in the accouut of the genus.

MEASUREMENTS.

Upper dentition, length $p^{\underline{4}}$–$m^{\underline{3}}$	.017
$P^{\underline{4}}$, length (*i. e.*, antero-posterior diameter)	.0035
$P^{\underline{4}}$, width (*i. e.*, transverse diameter)	.005
$M^{\underline{3}}$, length	.006
“ width	.004
Lower dentition, length	.035
“ “ “ $p_{\overline{4}}$–$m_{\overline{3}}$	.018
$P_{\overline{4}}$, length	.005
“ width	.004
$M_{\overline{3}}$, length	.006
“ width	.004
Occiput, height	.020
“ width at base	.020
Tympanic bulla, length	.014
Zygomatic arch, length	.032
Mandible, length from condyle	.047
“ depth at $p_{\overline{4}}$	.010
“ thickness at $p_{\overline{4}}$	.006
“ height of condyle	.020
“ “ “ coronoid	.018
Axis, length, including odontoid	.013
Axis, length excluding odontoid	.009
“ width of anterior face	.011
Third cervical, length of centrum	.007
Fourth “ “ “ “	.006
Fifth “ “ “ “	.008
Humerus, width of distal end	.011
“ “ “ trochlea	.008
Ulna, width at sigmoid notch	.005
“ “ “ distal end	.002
Radius, approximate length	.042
“ width of proximal end	.0063
Metacarpal III, length	.013
“ proximal width	.003
“ distal width	.003
Patella, length	.010
“ width	.005
Calcaneum, length	.017
“ “ of tuber	.007
Metatarsal III, proximal width	.0035
“ “ distal width	.004

PERIMYS PUERASTER Ameghino.

Sphiggomys pueraster Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 143.

Perimys pueraster Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 72.

Though known only from a single fragment of the mandible, containing the broken bases of the incisor and premolar, this is probably a valid species. It is considerably larger than *P. puellus*, and the mandible, though with very low horizontal ramus, is much more robust than in that species; below $p_{\overline{4}}$ it measures 10 mm. in depth and 9 in thickness. $P_{\overline{4}}$, which has an antero-posterior diameter of 6 mm. and a transverse width of 3 mm. and is thus narrower and more elongate than in the preceding species, has its valley turned directly forward.

PERIMYS ÆMULUS Ameghino.

(Plate LXVIII, Fig. 8.)

Perimys æmulus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 72.

This species also is known only from fragments of the mandible, but is clearly distinguished by its large size, which approximates that of *P. onustus* and *P. impactus*, from which it differs in the character of $p_{\overline{4}}$. This tooth is of the same form as in *P. puellus*, with the long diameter coincident with the long axis of the jaw and the valley opening directly forward. The lower incisor is relatively broad and its anterior face is depressed and striate; $m_{\overline{2}}$ has an internal pillar, but $m_{\overline{1}}$ has not.

MEASUREMENTS.

Lower dentition, length $_{\overline{1}}$–$m_{\overline{2}}$	.036	$P_{\overline{4}}$, width (*i. e.* transverse diameter)	.004
" " " $p_{\overline{4}}$–$m_{\overline{2}}$	.020	$M_{\overline{2}}$, length	.0065
Lower incisor, width	.0045	" width	.007
$P_{\overline{4}}$, length (*i. e.* antero-posterior diameter)	.0085		

PERIMYS ZONATUS Ameghino.

Sphiggomys zonatus Amegh.; Enumeracion sistem, etc.; 1887, p. 12.

Perimys zonatus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 72.

Unfortunately, I have seen no example of this remarkable species and therefore merely translate Ameghino's descriptions in somewhat abbreviated form.

"Molars formed by two laminæ, separated by a groove and united at one end, as in *Perimys*, but more compressed and the laminæ not placed in complete juxtaposition, but obliquely for only one-half or one-third of the width and with perpendicular, enamel-free bands" ('87^{b}, 12).

"The lower molars measure 4 mm. in width by 9 mm. in length; they are implanted more obliquely than in any of the other genera, so much so that they may be said to be placed with their major diameter in almost the same direction as the long axis of the jaw and in such a way that the succeeding molar is placed with its antero-internal border against the postero-external border of the tooth in front of it" ('89^{b}, 170; Pl. VII, figs. 23, 24).

"Size considerable, larger than *Lagostomus trichodactylus*. Upper molars of the same type as in *Perimys*, but implanted much more obliquely to the long axis of the jaw and more compressed antero-posteriorly" ('91^{b}, 143).

The following species are represented by such incomplete materials as to permit of no satisfactory determination of their validity.

PERIMYS PLANARIS Ameghino.

Perimys planaris Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 144.
Perimys planaris Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 71.
Perimys planaris Amegh.; Segundo Censo de la Repúb. Argent.; T. I, 1898, p. 179.

PERIMYS ANGULATUS Ameghino.

Perimys angulatus Amegh.; Rev. Argent. de Hist. Nat.; T. I, 1891, p. 301.
Perimys angulatus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 72.
Perimys angulatus Amegh.; Segundo Censo de la Repúb. Argent.; T. I, 1898, p. 179.

PERIMYS PACIFICUS Ameghino.

Perimys pacificus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 72.

Perimys pacificus Amegh.; Segundo Censo de la Repúb. Argent.; T. I, 1898, p. 179.

PERIMYS REFLEXUS Ameghino.

Perimys reflexus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 72.

Perimys reflexus Amegh.; Segundo Censo de la Repúb. Argent.; T. I, 1898, p. 179.

PERIMYS DIMINUTUS Ameghino.

Perimys diminutus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 73.

Perimys diminutus Amegh.; Segundo Censo de la Repúb. Argent.; T. I, 1898, p. 179.

PROLAGOSTOMUS Ameghino.

(Plate LXVIII, Figs. 15–19.)

Prolagostomus Amegh.; Enumeracion sistem., etc.; 1887, p. 11.

Lagostomus Amegh. in part; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent.; 1889, p. 185.

? *Sphæramys* Amegh.; Enumeracion sistem., etc.; 1887, p. 13.

? *Sphæromys* Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent.; 1889, p. 169.

This genus is much less abundant and varied than the preceding one and is even less well known, owing to the scanty and fragmentary nature of the material.

The incisors are relatively narrower and more slender than in *Viscaccia* and differ from those of *Perimys* in having decidedly more convex faces; another difference from the latter genus is in the much greater length of the lower incisor, which extends for nearly or quite the whole length of the molar series. The grinding teeth are composed of oblique laminæ in close juxtaposition, very much like those of *Viscaccia*, but apparently without cement between the laminæ, which are separated by a single layer of thin enamel, which, however, is but little thinner than that on the periphery of the tooth; the laminæ are demarcated by a vertical groove, which in the upper teeth is internal and in the lower teeth external; the latter, except usually $m_{\overline{3}}$, have masticating surfaces of somewhat pyriform shape, the postero-internal end being narrow and compressed. The last upper molar differs from the others in having a third, posterior lamina, the development of which differs in the various species and is also subject to considerable individual variation. The two rows of upper teeth converge anteriorly though not so strongly as in *Perimys.* In the lower grinding teeth there is not only a well defined external vertical groove, but the anterior lamina projects outward beyond the posterior one, especially in $m_{\overline{3}}$, in which the posterior lamina is very narrow; these teeth have no distinct internal side, the anterior side curving gradually into the posterior without angulation.

Though the skull is far from being completely known, it evidently agrees in essentials with that of *Perimys* and *Viscaccia* and is rather more like the latter than the former, while in some respects it is intermediate between the two. The occiput is like that of *Perimys* in shape, in the median convexity and in the absence of any vacuity above the foramen magnum, but the bones are thinner and the periotic is more extensively exposed upon the occipital surface, though less than in *Viscaccia*, and the mastoid process is very small. As in the latter genus, there is no fossa between the squamosal and exoccipital, this region being made convex by the protuberance of the periotic, along which runs the continuation of the occipital crest, which is less prominent than in the modern genus. The condyles have the same high and narrow shape as in the latter, but the paroccipital processes, which are broken in all the specimens, were evidently smaller. Like that of *Perimys*, the tympanic bulla is largely inflated, and the opening into it, below the auditory meatus, is also large; anteriorly the bulla sends forward a process to connect with the pterygoid. The supramastoid process of the squamosal is relatively wider than in *Viscaccia* and the sagittal and temporal crests are more prominent, while laterally the parietals are more concave.

The rostrum differs much in its proportions in the various species; the nasals are quite flat anteriorly and do not show the foliate shape seen in *Perimys* and *Viscaccia.* At least, this is the case in *P. profluens*, the only species in which the nasals are known. The premaxillæ are shorter and the predental portion of the maxillaries longer than in the recent genus, and the fossa for the preorbital part of the masseter muscle is shallower, but has much the same shape. The incisive foramina are larger and the premaxillary spines are broader than in the latter, and, in some species at least, there is an opening in the median line, between the premaxillaries and in advance of the incisive foramina, as is also the case in *Perimys* and *Viscaccia*. Nearly the whole of the hard palate is made up of the wedge-like palatines, the maxillaries having practically no palatine processes; the median ridge and posterior spine of the palatines are quite as in *Viscaccia*.

In all the examples of the mandible that I have seen the ascending ramus is lacking, and nothing is known of the condyle, coronoid or angle. The horizontal ramus is very much like that of *Viscaccia* and differs from that of *Perimys* in the small size of the masseteric crest and fossa, but the symphysial region is somewhat shorter and less procumbent than in the modern genus, the ventral border inclining more steeply upward. The ventral surface in this region has the same finely punctate appearance as in *Viscaccia*, but the punctate area is extended farther back along the whole length of the incisive alveolus.

A few fragments of the hind limb have been found in association with *P. divisus;* these differ from the corresponding parts of *Perimys* in their relatively much greater size, in which respect they even surpass those of *Viscaccia*. The ilium has its principal diameter directed more dorsoventrally than in the latter; the peduncle is shorter and the anterior expansion greater and more abrupt, and the ilio-pectineal process is decidedly better developed, while the prominent acetabular border, so far as it is preserved, pursues a somewhat less oblique course; the iliac surface is quite broad.

None of the fore limb bones has yet been found, so that it is not possible to make any direct comparison between the fore and hind limbs. However, as the femur and tibia are far larger in proportion to the size of the head than in *Perimys*, it may be inferred that the difference in the relative lengths of the fore and hind limbs was at least as great as in *Viscaccia*.

The femur differs in several respects from that of *Perimys*, in which respects it approximates that of the recent genus. As already mentioned, it is relatively even larger than in the latter, but as *Prolagostomus* was actually a much smaller animal, the relation may be as well expressed by saying that the head is proportionately smaller in the latter. In proportion to its length, the femur is more slender than in *Viscaccia;* the head is small, hemispherical and set upon a slender neck; the great trochanter has lost its epiphysis in all the specimens, but was evidently very large, and the digital fossa is very deep; the second trochanter is prominent, but less massive than in the modern genus, and, as in the latter there is no trace of a third trochanter. The shaft is much stouter than in *Perimys* and has not such a cylindrical shape, but is antero-posteriorly compressed; a strong linea aspera externa runs down the shaft for a greater or less distance from the great trochanter. The condyles project more prominently behind the plane of the shaft than in *Viscaccia* and the rotular groove is more symmetrical, the external border being raised as high as the internal.

There is no way of determining the length of the tibia from the fragments, but it clearly was very much longer and heavier than in *Perimys*, more slender than in *Viscaccia* and it differs in several respects from the latter; the external condyle has no such hook-like process from its postero-external angle, the cnemial crest is decidedly less prominent and the proximal part of the shaft is more deeply channelled on the posterior side. The distal end is very much as in *Viscaccia;* the astragalar surface is asymmetrical, with much larger facet for the external than for the internal condyle; the intercondylar ridge is low, but the posterior, tongue-like process is both long and broad; the internal malleolus, which is quite prominent, is not grooved by a tendinal sulcus, as it so conspicuously is in *Perimys.*

Relationships.—While *Prolagostomus* is still far too imperfectly known for any definite determination of its phylogenetic significance, yet all that we do know concerning it confirms Ameghino's original suggestion ('87^b, 12) that it is the actual and direct ancestor of *Viscaccia.* On the other hand, it has certain unmistakable likenesses to *Perimys*, which indicate that some early, pre-Santacruzian genus, not very far removed from the latter, was the common ancestor of the family.

I have seen no example of the supposed genus *Sphæromys*, but Ameghino's description of it strongly suggests that it was founded upon a young individual of the present genus, with dp^4 still in place.

PROLAGOSTOMUS PUSILLUS Ameghino.

(Plate LXVIII, Fig. 17.)

Prolagostomus pusillus Amegh.; Enumeracion sistem., etc.; 1887, p. 11.
? Sphæramys irruptus Amegh.; *Ibid.*, p. 13.

? Sphæromys irruptus Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent.; 1889, p. 169.

This, the smallest known species of the genus, is distinguished not only by its small size, but also by the character of m^{3}, in which the posterior prolongation is short, straight, directed backward, not obliquely inward, and there is no groove demarcating the process from the second lamina. The incisors are very narrow, hardly exceeding 1 mm. in width. In the mandible p_{4} and m_{3} are smaller, m_{1} and $_{2}$ somewhat larger.

The upper grinding series measures 10 mm. in length, and the lower 9 mm.

PROLAGOSTOMUS DIVISUS Ameghino.

(Plate LXVIII, Fig. 16.)

Prolagostomus divisus Amegh.; Enumeracion sistem., etc.; 1887, p. 11.

This species is considerably larger than the preceding one, from which it farther differs in the larger size of the posterior prolongation of m^{3}, which is set off from the second lamina by a deep groove on the inner side; the size and direction of this process are subject to much individual variation and may differ notably on the two sides of the same skull, but in all cases it is larger than in *P. pusillus* and the demarcating groove is never absent.

The incisors are narrow and slender, the thickness hardly exceeding the width. In the lower series, p_{4} is considerably and m_{3} slightly smaller than m_{1} and $_{2}$.

The rostrum is strikingly long, narrow and tapering, but with relatively large dorso-ventral diameter; the palate is short and transversely concave, with very prominent median ridge, and the posterior nares are large.

In Ameghino's measurements of this and the following species are discrepancies, probably typographical, which make it impossible to use them for purposes of comparison. The two individuals in the Princeton collection, from which the following measurements are taken, appear to be somewhat larger than the type specimen.

MEASUREMENTS.

	No. 15,570	*No. 15,882*
Upper dentition, length	.036	
" " " p^{4}–m^{3}	.014	
Upper incisor, width	.002	
" " thickness	.0023	

	No. 15,570	*No. 15,882*
Lower dentition, length		.0325
“ “ “ p_4–m_3		.015
Lower incisor, width		.0023
“ “ thickness		.0025
Occiput, height	.017	
“ width at base	.026	
Tympanic bulla, antero-posterior diameter	.012	
Palate, width at p^4	.0035	
“ “ “ m^2	.008	
Rostrum, length	.019	
“ width at base	.010	
“ “ “ anterior end	.007	
“ dorso-ventral height	.011	
Mandible, depth at p_4		.009
“ “ at notch in front of p_4		.0065
“ thickness at p_4		.0075
Femur, estimated length from head	.058	
“ proximal width	.013	
“ distal width		.011
“ width of shaft in middle	.006	.0063
“ thickness of shaft in middle	.0045	.005
Tibia, proximal width		.012
“ “ thickness		.010
“ distal width		.008
“ “ thickness		.006

Prolagostomus profluens Ameghino.

(Plate LXVIII, Figs. 15–18.)

Prolagostomus profluens Amegh.; Enumeracion sistem., etc.; 1887, p. 11.

The following description is founded upon a specimen in the collection of the American Museum of Natural History (No. 9,588). In size this species is nearly the same as the preceding one, but is decidedly heavier and more robust. The incisors are distinctly stouter and in the upper grinding teeth the anterior lamina projects more prominently on the outer side. The posterior prolongation of m^2 varies considerably in size, shape and direction, but it is usually larger than in *P. divisus* and is directed more obliquely inward. The rostrum differs notably in appearance from that of the last named species; its length is not certainly known, but it is much broader and tapers less anteriorly, yet its dorso-ventral height is less. The unpaired opening between the premaxillæ and in front of the incisive foramen is either wanting, or else has a more posterior position than in *P. divisus.* The palate is less concave transversely and the median ridge is less prominent than in the latter, while the posterior nares do not extend so far forward.

MEASUREMENTS.

Upper dentition, length $p^{\underline{4}}$–$m^{\underline{2}}$	.015	Palate, width at $m^{\underline{2}}$	.009
Upper incisor, width	.0025	Rostrum, width at base	.013
" " thickness	.0035	" " " anterior end	.010
Palate, width at $p^{\underline{4}}$	.004	" dorso-ventral height	.009

PROLAGOSTOMUS IMPERIALIS Ameghino.

(Plate LXVIII, Fig. 19.)

Prolagostomus imperialis Amegh.; Enumeracion sistem., etc.; 1887, p. 12.

This species is known only from mandibles, the best preserved of which is No. 9,587 of the American Museum's collection. It is distinguished not only by being the largest known species of the genus, but also by the slenderness of the incisors, which are actually thinner than in *P. profluens* and are therefore relatively much smaller. Another distinction from all the preceding species is the relative size of the grinding teeth, the series of which is proportionately longer, making up more than half of the total distance from the incisor to the last molar, while the symphysial region is relatively shorter. The premolar is small; $m_{\overline{3}}$ has a much greater antero-posterior length than any of the others, but it is somewhat narrower than $m_{\overline{2}}$.

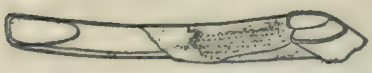
MEASUREMENTS.

Lower dentition, length	.036	Lower incisor, thickness	.003
" " " $p_{\overline{4}}$–$m_{\overline{3}}$	.019	Mandible, depth at $p_{\overline{4}}$	.011
Lower incisor, width	.0025	" thickness at $p_{\overline{4}}$	.007

PROLAGOSTOMUS OBLIQUIDENS sp. nov.

The type of this species is unfortunately a mere fragment of the mandible, containing the incisor and the premolar, but the latter is so peculiar and characterisistic that the distinctness of the species is open to little doubt. In size, the present species is about the same as *P. imperialis*, but the premolar is much narrower and is so rotated that its long diameter is almost coincident with the axis of the jaw, a character which is

FIG. 42.



Type of *Prolagostomus obliquidens;* mandible, crown view, × $\frac{2}{1}$.

found in no other species of the genus, but occurs in several species of *Perimys;* the external groove between the laminæ, which is unusually deep, thus becomes anterior. The lower incisor is of almost exactly equal width and thickness and is therefore thinner than in *P. imperialis.*

The type specimen was collected by Mr. Hatcher at Killik Aike.

MEASUREMENTS.

Length $_{\overline{1}}$–$\text{p}_{\overline{4}}$, inclusive	.022	$\text{P}_{\overline{4}}$, length (*i. e.*, antero-posterior diameter)	.004
Lower incisor, width	.0025	$\text{P}_{\overline{4}}$, width (*i. e.*, transverse diameter)	.002
" " thickness	.0025		

PROLAGOSTOMUS AMPLUS Ameghino.

Prolagostomus amplus Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 73.

Of this species, only the type specimen, a mandibular ramus, is known, but it appears, nevertheless, to be a valid one. The lower grinding series, which measures 12.5 mm. in length, is given a different appearance from that of any of the preceding species by having all the teeth of nearly the same size.

Ameghino has named two additional species of *Prolagostomus*, concerning which I am not able to add anything to his account.

PROLAGOSTOMUS LATERALIS Ameghino.

Lagostomus lateralis Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent.; 1889, p. 185.

Prolagostomus lateralis Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 73.

Prolagostomus lateralis Amegh.; Seg. Censo de la Repúb. Argent.; T. I, 1898, p. 179.

PROLAGOSTOMUS PRIMIGENIUS Ameghino.

Lagostomus primigenius Amegh.; Contrib. al. Conoc. de los Mam. Fos. de la Repúb. Argent.; 1889, p. 186.

Prolagostomus primigenius Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 73.

Prolagostomus primigenius Amegh.; Seg. Censo de la Repúb. Argent.; T. I, 1898, p. 179.

PLIOLAGOSTOMUS Ameghino.

Pliolagostomus Amegh.; Enumeracion sistem., etc.; 1887, p. 12.

This very rare and imperfectly known genus is closely allied to the preceding one, but differs from it: (1) in the shortness of the lower incisor, which reaches only to $p_{\overline{4}}$, instead of extending the whole length of the grinding series, and therefore the protuberance along the inner side of the mandible, so conspicuous in *Viscaccia* and *Prolagostomus*, is wanting; (2) in the form of the grinding teeth, which are much less oblique to the axis of the jaw and which, at least $m_{\overline{2}}$ and $_{\overline{3}}$, have as great an antero-posterior diameter internally as externally; the same teeth have a definite inner side, which forms an angle with the anterior side, not curving into it gradually. Furthermore, in some of the teeth, notably $m_{\overline{1}}$, there is an internal groove between the laminæ, not so deep as the outer groove, but quite distinct.

In the Ameghino collection are some upper molars referred to this genus, which differ from those of the mandible in being of more oval shape, while the posterior prolongation of $m^{\underline{2}}$, or incipient third lamina, is directed transversely, not backward, or obliquely inward, as it is in the preceding genus.

The mandible resembles that of *Prolagostomus* in shape and in the small size of the masseteric crest and fossa.

Too little is known of *Pliolagostomus* for any definite determination of its phylogenetic significance, but it appears to be merely an aberrant member of the family, which has left no descendants.

PLIOLAGOSTOMUS NOTATUS Ameghino.

(Plate LXVIII, Fig. 20.)

Pliolagostomus notatus Amegh.; Enumeracion sistem., etc.; 1887, p. 12.

This is a very small animal, exceeding *Prolagostomus pusillus* but little in size. In the type specimen $p_{\overline{4}}$ and $m_{\overline{3}}$ are considerably smaller than $m_{\overline{1}}$ and $_{\overline{2}}$. In the Princeton collection is a mandible (No. 15,087) of a very young animal, in which $p_{\overline{4}}$, though erupted, had not yet come into use, which differs from the type in several respects and, though of similar size, may possibly represent a different species; $p_{\overline{4}}$ is very small, but $m_{\overline{3}}$ is larger than $m_{\overline{1}}$, and the mandible is deeper anteriorly.

Measurements.

	Type.	*No. 15,087.*
Lower dentition, length	.019	
" " " $p_{\overline{4}}$–$m_{\overline{3}}$	.011	.011
Mandible, depth below $p_{\overline{4}}$	.005	.0065
" " " $m_{\overline{3}}$	.008	.008

SCOTÆUMYS Ameghino.

Scotæumys Amegh.; Enumeracion sistem., etc.; 1887, p. 12.

It is most unfortunate that this highly interesting genus should be so rare as to be known only from a few teeth. The upper molars are composed of two laminæ, separated internally by a deep enamel fold or valley, the breadth of which diminishes much with abrasion. In addition to the two principal laminæ, there is an incipient third one, in the form of a process from the outer end of the second lamina. Each tooth thus has much the appearance of $m^{\underline{2}}$ in *Prolagostomus pusillus*, except that the posterior process is rather shorter. Of the lower teeth only $p_{\overline{4}}$ is known and in this the incipient third lamina is anterior.

Ameghino's suggestion ('89^{b}, 188), that genus is the forerunner of *Chinchilla* and *Lagidium* is probably correct, but the material is far too scanty for any satisfactory determination of this question.

Scotæumys imminutus Ameghino.

(Plate LXVIII, Fig. 22.)

Scotæumys imminutus Amegh.; Enumeracion sistem., etc., 1887, p. 12.

The single known species is very small, the length from p^{4} to $m^{\underline{2}}$, inclusive, being 6 mm.; the upper teeth are obliquely implanted and the two dental series converge anteriorly, the palate measuring 2.5 mm. in width at p^{4} and 5 mm. at $m^{\underline{2}}$.

SPHODROMYS Ameghino.

Sphodromys Amegh.; Enumeracion sistem., etc.; 1887, p. 13.

Of this remarkable genus I have seen only two specimens in the Ameghino collection, neither of which is the type; both are fragments of mandibles, one containing $p_{\overline{4}}$ and the other $dp_{\overline{4}}$. According to Ameghino (89^{b}, 170), the lower molars are much like those of *Perimys*, but the premolar is entirely different from that of any other known member of the family; in the abraded state it has one deep external and two much shallower internal enamel folds, which divide the tooth into two principal lobes, in the anterior one of which is a minute enamel lake. The milk premolar is much more complex. The incisor is short and extends only to the premolar. The masseteric crest is very prominent.

SPHODROMYS SCALARIS Ameghino.

(Plate LXVIII, Fig. 21.)

Sphodromys scalaris Amegh.; Énumeracion sistem., etc.; 1887, p. 13.

The extremely small size of the animal is the only specific character that presents itself. Length from $p_{\overline{4}}$ to $m_{\overline{3}}$, inclusive, 7 mm.

CAVIIDÆ.

(*Eocardidæ* Amegh.)

EOCARDIA Ameghino.

(Plates LXVIII, Figs. 23–25; LXIX, 1–10, 17; LXXI.

Eocardia Amegh.; Observ. gén. sobre el Orden de los Toxodontes, etc.; La Plata, 1887, p. 65.

Dicardia Amegh. (subgenus); Revist. Argent. de Hist. Nat.; T. I, 1891, p. 302.

Dicardia Amegh. (genus); Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 74.

Tricardia Amegh. (subgenus); Revist. Argent. de Hist. Nat.; T. I, 1891, p. 302.

Tricardia Amegh. (genus); Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 74.

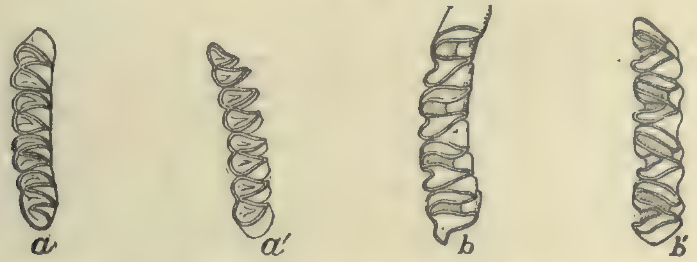
Hedymys Amegh.; Enumeracion sistem., etc.; 1887, p. 14.

Hedimys Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie; 1894, p. 74.

This is one of the most abundant and characteristic of Santa Cruz rodents, of which nearly the entire skeleton is represented in the Princeton collection, so that it is possible to make satisfactory comparisons with other contemporary and with recent genera.

The dentition closely resembles that of *Dolichotis*, though in several respects that of the Santa Cruz genus is much more primitive. The incisors are quite narrow and slender and have convex faces; they are of no great length, the lower one extending only to the line of $\mathrm{m}_{\overline{2}}$. The grinding teeth are prismatic and rootless. The upper premolar is not molariform, as it is in *Dolichotis*, but is simpler than the molars, consisting of a single, subtriangular column, with a well-marked groove upon the anterior face. There is much variation, sometimes even in the same individual, in the size of this tooth and in the depth of the groove. The first and second upper molars are each composed of two triangular prisms, with apices directed inward and joined externally at the bases; the faces of the prisms are slightly convex, giving them a heart-like shape on the masticating surface; more or less cement is deposited in the valley between the prisms, at least in some of the species, otherwise these teeth are quite as in *Dolichotis*. The third molar has a postero-external prolongation, which differs somewhat in size and shape in the various species, but is always smaller than in the recent genus.

FIG. 43.

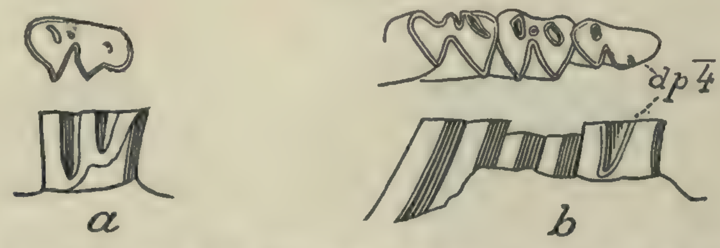


Grinding teeth of Caviidæ. *a*. Right upper teeth, *a'* right lower teeth of *Dolichotis magellanica*, × $\frac{1}{1}$. *b*. Right upper teeth, *b'* right lower teeth of *Cavia cobaya*, × $\frac{2}{1}$.

In the crowns of the unworn teeth (see Pl. LXVIII, fig. 27) may be observed three broad and shallow valleys, which invade the crown from the outer side, one in each prism and one in the space between the prisms, which space is much broader than at a subsequent stage. Very early these valleys become separated from the outer wall of the tooth and converted into enamel lakes and, by the time that the animal is fully adult, even the lakes have been entirely worn away (*cf.* figs. 23*b* and 27, Pl. LXVIII), while the permanent internal valley is so extended outward that the prisms are connected only by a very narrow neck of enamel and dentine. All the upper grinding teeth are so curved as to present the grinding surfaces somewhat externally, but the curvature is not so strong as in the recent *Cavia* and *Dolichotis*, and the anterior convergence of the two upper dental series is much less than in them. The fore-and-aft plane of the grinding surfaces is nearly horizontal, without the inclination downward and forward which is so conspicuous in *Dolichotis*.

The lower premolar is subject to much individual variation, as well as to considerable specific differences; I have observed several instances in which notable differences may be seen in the form of this tooth on the two sides of the same jaw. The crown is molariform and consists of two prisms, the anterior one of which is usually smaller than the posterior and may be of either elliptical or triangular cross section, while its anterior face may or may not have a vertical groove. When present, this groove varies greatly in depth, even in the same individual and in some species it becomes so deep as to divide the anterior prism into two, but every stage of the transition to this extreme may be observed. The lower molars consist each of two triangular prisms, with the valley between them opening outward, and the teeth are curved, so as to present the grinding surfaces somewhat inward and thus oppose those of the upper teeth. The unworn lower teeth have internal shallow valleys, corresponding in number and position to the external valleys of the upper teeth. In both upper and lower molars the narrow edges of the prisms are usually set off by exceedingly fine grooves to form obscure pillars; this feature is, however, extremely variable.

Fig. 44.



Eocardia sp., teeth of young individuals, lower right side, external and crown views, × $\frac{2}{1}$. *a.* Dp$_{\overline{4}}$ in very young stage. *b.* Dp$_{\overline{4}}$, m$_{\overline{1}}$ and $_{\overline{2}}$, later stage, A. M. N. H.

The milk premolars, which remain in function until after the eruption of the last molar, differ from all of the permanent teeth in having roots. Otherwise, dp^4 has the pattern of the molars (Pl. LXVIII, fig. 27) and is composed of two prisms, separated by a deep internal valley, with three enamel folds from the outer side of the crown, which soon become isolated as lakes. In the mandible, $\text{dp}_{\overline{1}}$ is more complex than the molars (Pl. LXIX, fig. 17); in addition to the principal internal valley there is a second one, anterior to the former and of less vertical extent; by the time that the tooth is ready to be shed, this anterior internal valley is a mere notch in the inner wall of the crown and may have disappeared altogether. The three shallow external folds correspond in shape and position to those of the molars, but have been worn away before the tooth is replaced.

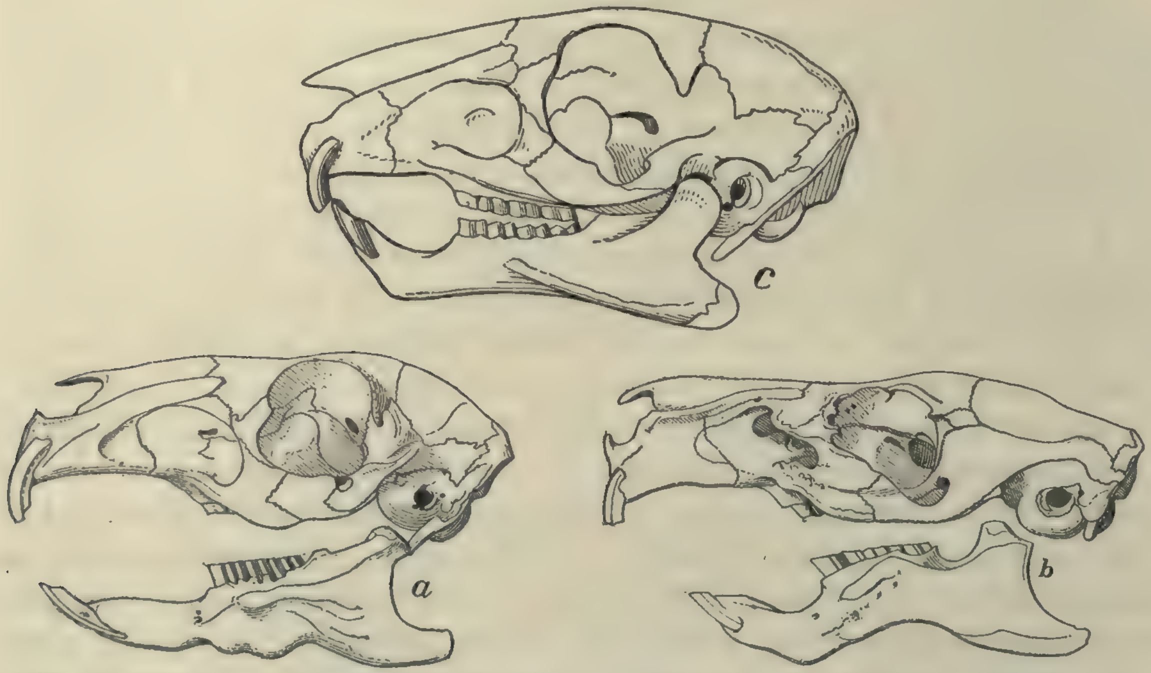
Skull.—So far as I am aware, no entirely complete skull of this genus has yet been found, but, by combining the various specimens, it is possible to ascertain almost all the significant facts of structure. The skull has resemblances to those of both *Dolichotis* and *Cavia;* it is narrower and more slender than the former, especially in the cranial and interorbital regions and the upper contour is straighter. (The strongly arched appearance seen in the specimen figured in Pl. LXVIII, fig. 23, is chiefly due to crushing, which has much depressed the parietal region.

To a certain extent, the occiput is intermediate in character between that of *Dolichotis* and that of *Cavia*, being lower and wider than in the former, higher and narrower than in the latter; the foramen magnum is relatively smaller and the median vertical crest less prominent than in either of the recent genera, while the paroccipital processes are shorter. As in *Dolichotis*, the periotic does not appear upon the occipital surface, and apparently there is no mastoid process. None of the specimens displays clearly the limits of the periotic, but in the nearly allied genus *Schistomys* this bone has much the same shape and connections as in *Dolichotis.* The tympanic bulla is of only moderate size, and is relatively less inflated than in the last-named genus, but with quite similar short and incomplete tubular meatus. The parietal region is more or less injured in all the specimens: so far as they are preserved, the parietals have a smoothly rounded surface, without any trace of sagittal crest or area, or temporal ridges. The supraoccipital is extended farther upon the dorsal surface of the cranium than in *Cavia.* The body of the squamosal is larger than in the recent genera, but the supramastoid process is narrower and there is no such groove above the root of the zygomatic process as is seen in *Dolichotis.*

The zygomatic arch is more elongate and the jugal is longer and more slender than in the recent genera, as in which it does not extend to the lachrymal; in shape it has more resemblance to that of *Cavia.* The lachrymal is considerably smaller than in either of the existing genera. The frontals are but slightly convex, without protuberances for the sinuses; the supraorbital border is thin and prominent, but entire, without notch; the postorbital process corresponds in position to that of *Dolichotis*, but is somewhat shorter. The nasals are elongate and broad and their anterior portion is transversely convex; the free ends resemble those of *Cavia* in being bluntly pointed, without deep lateral notches.

The premaxillaries are shorter than in the modern genera, and the edentulous portion of the maxillaries longer, making up nearly half of the rostrum; the incisive foramina are larger and invade the maxillaries more deeply. The hard palate is quite different from that of the existing genera; it narrows anteriorly much less, as is determined by the lesser degree of convergence of the dental series, and is more extensively made up by the much larger palatines, and is much less reduced by the posterior nares, which are smaller, extending only to m^{3}, and are of a different shape, with more nearly parallel sides and with a median spine from the anterior border. The pterygoid fossæ are large, but I have not been able to de-

FIG. 45.



Skulls of Caviidæ, left side. *a. Dolichotis magellanica*, × $\frac{1}{2}$. *b. Cavia cobaya*, × $\frac{1}{1}$. *c. Eocardia excavata*, × $\frac{1}{1}$.

termine whether they are perforated so as to communicate with the orbits. This skull agrees with that of *Dolichotis* in the moderate size of the foramen lacerum medium, there being no such great vacuity at this point as occurs in *Cavia*.

The mandible has a general resemblance to that of *Dolichotis*, but, as Ameghino has pointed out, *Eocardia* differs from all the existing members of the family in the position of the masseteric crest. In the recent genera the crest has a very elevated position and an almost horizontal course, with a deep groove between itself and the alveolar border, but in the fossil the crest is much lower down on the jaw and runs obliquely downward and backward, forming the ventral border of the angle. The coronoid process, though very much reduced, is better developed than in *Dolichotis* and rises higher than in *Cavia*, though, owing to the shallowness of the sigmoid notch, it appears to be shorter; the condyle has much the same shape as in the former, as has also the masseteric fossa. The angular process has been broken and lost from all the specimens. The horizontal ramus is quite stout and its ventral border has several protuberances for the teeth, which, however, are far less conspicuous than in *Dolichotis;* the symphysis is shorter and less procumbent than in the latter, the chin rising much more steeply.

Vertebral Column and Ribs (Plate LXXI). — The neck is rather short and slender. The atlas is short, broad and depressed, without neural spine and with only a vestige of the hypapophysis; the transverse processes also are short in both dimensions and are less produced behind the posterior cotyles than in *Dolichotis*. The neural spine of the axis is relatively considerably smaller than in the latter, but of not dissimilar shape; the centrum is short and much depressed, the cotyles for the atlas rising high upon the sides of the large neural canal. The other cervicals are small and lightly constructed, but without other peculiarity than the absence of neural spines from the third, fourth and fifth.

The number of trunk vertebræ has not yet been definitely determined, though there is reason to believe that it was the same as in *Dolichotis*, Th. 12, L. 8, but, owing to the disparity in the length of the fore and hind limbs, the curvature of the back is different. In the anterior part of the thoracic region the neural spines are considerably shorter than in the recent genus, are very slender and have a strong backward inclination; posteriorly the spines diminish in length and increase in width, while the centra are enlarged. In the lumbar region, especially its hinder part, the centra are very large, indicating powerful and muscular loins; the neural spines, which increase in length posteriorly, are not much shorter, proportionately, than in the existing genus, but much more slender, and have a strong forward inclination; the metapophyses and anapophyses, on the other hand, are much more prominent, while the transverse processes are quite similar in the two genera.

The sacrum also is much like that of *Dolichotis*, but consists of only three vertebræ, the first of which alone is in contact with the ilia; the second and third vertebræ have very long and slender, cylindrical centra; the spines, which are separate, not fused into a continuous ridge, are elongate, though shorter than in the modern genus. The short tail also is very much as in the latter, but is slightly longer and thinner, and the spines of the anterior caudals are not so long. Chevron bones were probably present, though none have been found.

The ribs, especially in the anterior part of the thorax, are much more slender and rod-like than in *Dolichotis*. The sternum is not known.

Appendicular Skeleton.—The scapula is relatively smaller than in *Dolichotis* and differs somewhat in shape; the coracoid border describes a wider curvature, making the prescapular fossa wider, and the glenoid border is more elevated; the incisura colli is very long, while the acromion has an even greater antero-posterior expansion, but this expansion is less sudden and the posterior process, though nearly as long as in *Cavia*, is much broader. The coracoid is a well developed, incurved hook, but hardly so prominent as in *Dolichotis*.

The pelvis differs from that of *Dolichotis* in a number of details, as well as in its greater lightness and slenderness of construction. The ilium has a short peduncle, expanding suddenly into the large anterior plate, which is strongly everted; the prominent acetabular border has a more inferior position than in the existing genus, making the gluteal surface wider and more concave, and the iliac surface, which is more lateral than ventral, is narrower than in the recent genus and the ilio-pectineal process is much more prominent; the acetabulum is small and subcircular, with projecting border. The ischium, which is much shorter than the ilium, is laterally compressed and has an unusually deep and conspicuous sciatic notch; the tuberosity is smaller and less prominent than in *Dolichotis* and the descending process of the ischium is narrower, while the obturator foramen is of more irregularly quadrate, less oval form. The pubis is quite elongate, thin and laterally compressed; it forms a long symphysis with its fellow of the opposite side.

There is much more disparity between the lengths of the fore and hind limbs than in any existing member of the family.

The humerus (Plate LXIX, fig. 4) is very short and slender, but, except in size, has a close resemblance to that of *Dolichotis;* the tuberosities are reduced, the external one not rising above the level of the head, but is quite broad transversely; the shaft is slender and the deltoid ridge is but weakly developed. The distal end is narrow and the epicondyles nearly obsolete; there is no epicondylar foramen; the trochlea, the whole breadth of which is occupied by the radius, has the usual division into three parts, of which the median convexity is more prominent than in the recent genus; the anconeal and supratrochlear fossæ are deep and connected by a perforation.

No difference between *Eocardia* and *Dolichotis* is more striking than the great elongation of the fore-arm in the latter and its shortness in the former; instead of far exceeding the humerus in length, as it does in the modern genus, it is considerably shorter, so that the segments of the fore limb have more the proportions seen in *Cavia*.

The radius (Plate LXIX, fig. 5) is very slender; the proximal end is broad, occupying the whole humeral trochlea, with which it is so interlocked as entirely to prevent any movement of rotation. The shaft, which is antero-posteriorly compressed, is less strongly arched forward than in *Cavia*, and the distal end is but moderately expanded and has a shallow tendinal sulcus on the anterior side.

The ulna, though far shorter, is much stouter than in *Dolichotis* and has a shorter olecranon; the sigmoid notch is deep, describing more than a semicircle, and the shaft is as stout as that of the radius, quite as thick as in *Cavia*, but less curved; the distal end bears a narrow, convex facet for the pyramidal.

Of the manus (Plate LXIX, fig. 6) only the metacarpus and a few phalanges are known, but these suffice to show that it was very small. Almost certainly the number of digits is four. The functional metacarpals have the same arrangement as in the recent members of the family in two symmetrical pairs. Metacarpal II is short and slender, moderately expanded at the proximal end; as in *Dolichotis*, it has three carpal facets, but the proportions are different, that for the trapezoid being the largest, while in the modern genus the facet for the trapezium is much the largest and the contact with the magnum is more extensive than in the fossil. The nearly straight shaft is of transversely oval section; the distal trochlea is low and semicylindrical and has a low carina. Metacarpal III is much longer and stouter than II; on the radial side the proximal end is overlapped by that of II, but less extensively than in *Dolichotis* and the contact with the unciform is also smaller. The shaft is straight, antero-posteriorly compressed and broadening slightly toward the distal end. Metacarpal IV resembles III in length and thickness; it has but a comparatively narrow contact with the unciform, because of the manner in which III extends over it. Metacarpal V, which is considerably the shortest of the series, has a relatively wide proximal end, with a process from the fibular side which is not present in *Dolichotis;* the shaft is stout and somewhat curved.

Only a few phalanges have been found and these resemble the corresponding bones of *Dolichotis* on a very small scale.

The femur (Plate LXIX, fig. 8) is considerably shorter than in *Dolichotis* as compared with the size of the skull, but much longer in comparison with the humerus. The head is small, very symmetrically hemispherical and placed upon a very slender neck; the pit for the round ligament is very small and obscure; the great trochanter, though large, is much smaller than in the recent genus, as is also the digital fossa; the second trochanter is less prominent than in the existing type and there is no trace of a third trochanter. The shaft is stout and somewhat compressed antero-posteriorly; the condyles are shaped very much as in *Dolichotis*, but the rotular trochlea is narrower and more symmetrical, the outer border rising as high as the inner.

The patella is not unlike that of *Dolichotis*, but is narrower and especially thinner, with much less rugose anterior face.

As in the fore-arm, so in the leg, the bones of *Eocardia* are relatively far shorter than those of *Dolichotis*, though exceeding the ulna and radius in length to a much greater degree. The tibia (Plate LXIX, fig. 9) is but little longer than the femur and nearly twice as long as the radius, while in the modern genus both radius and tibia are remarkably elongate. In form, the tibia is much like that of *Dolichotis*, except for its greater slenderness and the smaller development of the cnemial crest; the proximal condyles are widely separated by the broad sulcus for the crucial ligament, and the hook-like process from the postero-external angle of the outer condyle is smaller than in the recent genus. The distal end has an asymmetrical surface for the astragalus, with much larger external condyle, prominent intercondylar ridge, which is invaded by a sulcus from the dorsal side, and very large posterior tongue; the internal malleolus is small, but distinct.

The fibula is very much less reduced than in *Dolichotis* and is even relatively stouter than in *Cavia;* the proximal end is narrow, but thick antero-posteriorly, the shaft is very irregular and the distal end forms a heavy external malleolus, grooved by the sulcus for the peroneal tendon on the outer side.

The pes (Plate LXIX, fig. 10) though far larger than the manus, does not exceed it so much as in *Dolichotis* and has more the proportions seen in *Cavia;* in structure it resembles that of the former genus, with several minor differences, the tarsus resembling that of *Cavia.* The calcaneum has a short heavy tuber, of trihedral shape, broad on the plantar side and contracting to a blunt edge on the dorsal; the external astragalar facet is large, convex and very oblique, presenting inward; the sustentaculum is heavy and not very prominent, with small, subcircular facet; the cuboid facet is deeply concave and very oblique, presenting inward rather than distally. The astragalus differs considerably from that of *Dolichotis*, especially in the narrowness of the neck and head and in the absence of the deep pit distal to the trochlea which is seen in the modern genus; the trochlea is very asymmetrical, owing to the large size of the outer condyle, and is quite deeply grooved. The navicular also is much narrower than in the last-named genus and the cuboid far shorter proximo-distally, and thicker planto-dorsally, but has a similar massive process from the whole plantar side, to the distal end of which is attached a sesamoid bone, just as in the modern genus; the facet on the distal end for metatarsal V is minute. The meso- and ectocuneiforms, especially the latter, are smaller than in *Dolichotis;* the entocuneiform has not been found, but its presence is demonstrated by the facets upon the second metatarsal.

It is almost certain that the number of functional metatarsals is three; these are very much larger than the metacarpals. Metatarsal II is long, relatively slender and asymmetrical; owing to the small size of the mesocuneiform, its proximal end rises much above that of III, as is universal in the rodents, and has an extensive lateral contact with the ectocuneiform; on the tibial side is an oblique bevelled surface for the entocuneiform, the shape of which makes it probable that no vestige of the hallux was retained. The shaft is slender, subtrihedral and curved, with concavity toward the tibial side, expanding slightly toward the distal end.

Metatarsal III is the longest and heaviest of the series and its apparent length is increased by its position in the foot, the proximo-distal length of the ectocuneiform so much exceeding that of the mesocuneiform, on the one hand, and that of the cuboid on the other. The tarsal facet is nearly plane and horizontal, without obliquity; the shaft is straight, broad and antero-posteriorly compressed, widening somewhat to the distal end; the trochlea is low, shorter proximo-distally than in *Dolichotis* and the supratrochlear fossa is smaller. Metatarsal IV is the counterpart of II in size and shape, but is somewhat more curved; on account of the extreme shortness of the cuboid, the head of this metatarsal rises higher above that of III than in the modern genus. On the fibular side of the head is a large depression and a very small articular surface, evidently for the rudimentary fifth metatarsal and, no doubt, this rudiment had much the same shape and relative size as in *Dolichotis*.

In proportion to the length of the metatarsals, the phalanges of the first row are more elongate and slender than in *Dolichotis*, though, like all parts of the limbs and feet, they are smaller in comparison with the head and vertebral column. The unguals are quite different from those of the recent genus, being more curved, slender and sharply pointed, with smaller distal cleft, and altogether more claw-like; the subungual process is very large and prominent.

Restoration (Plate LXXI). — The resemblance between the skeleton of *Eocardia* and and that of *Dolichotis* is obvious at the first glance, but there are many minor differences in all parts. The skull has a shorter, thicker and wider rostrum, and the symphysial region of the mandible is less procumbent. The neck is shorter and lighter and in the trunk the vertebral column has quite a different curvature, owing to the greater disparity in length between the fore and hind limbs, while in the lumbar, sacral and caudal regions the neural spines are shorter and much more slender. The tail is somewhat longer and thinner, and the ribs are thinner and less plate-like, making a smaller and lighter thorax. The limbs are much shorter and the feet smaller and, in particular, the fore limbs are very much less elongate; on the other hand, the hind limbs exceed the fore much more than in *Dolichotis*, in which the anterior and posterior extremities are of nearly equal length. The gait, it may be inferred from the structure of the feet, was completely digitigrade. In brief, it would hardly be inaccurate to describe *Eocardia* as a smaller, lighter and shorter-limbed *Dolichotis*.

In the following comparative table the distance from the occipital condyle to the premolar, inclusive, is taken as 100 and the other dimensions are calculated in percentages of that distance. This standard is chosen rather than the entire length of the skull, because it eliminates the different proportions of the rostrum.

MEASUREMENTS.

	Schistomys ellipticus.	*Eocardia excavata.*	*Dolichotis magellanica.*
Distance, occipital condyle to p^4 inclusive	100 (49 mm.)	100 (47 mm.)	100 (70 mm.)
Scapula length	109.6	91.4	121.4
Pelvis, length		153.1	201.2
Humerus, length	126.5	110.5	165.7
Radius, length		87	214.2
Ulna, length		112.7	250
Metacarpal III, length		34.8	58.5
Femur, length from great trochanter	171.4	144.6	184.2
Tibia, length	175.5	148.9	230
Tarsus, length		44.6	75.7
Metatarsal III, length	63.2	51	97.1
Phalanx 1, digit III, length		25.3	32.4

Relationships.—Though *Eocardia* is probably not ancestral to any existing genus, it is, nevertheless, a type of great interest and importance, for it brings before us, in somewhat modified shape, the common ancestral form of *Dolichotis* and *Cavia* and possibly even of *Hydrochœrus* also. In comparing the two former genera, we see that *Cavia* has the more highly differentiated dentition and *Dolichotis* the more specialized skull, limbs and feet. *Eocardia* shows the beginning of the *Cavia* type of grinding teeth in the shallow accessory enamel folds and in the presence of cement. In the latter, however, only one such fold is deepened and made permanent in each tooth, while *Eocardia* has three, and this gives at least a hint of the manner in which the highly complex molars of *Hydrochœrus* have arisen; in *Dolichotis* the teeth have been simplified by the loss of the accessory enamel folds, reducing the crown to two simple prisms. *Luanthus*, a genus from the Patagonian beds, in which the grinding teeth are all rooted and the accessory folds are much deeper vertically than in *Eocardia*, nearly or quite represents the common stock whence all the existing members of the *Caviidæ* have been derived; its tooth-pattern shows that already in *Eocardia* the accessory folds were in process of disappearance.

Synonomy.—Ameghino originally referred all the species to the single genus *Eocardia;* later ('91, 302) he established four subgenera, *Eocardia*, *Procardia*, *Dicardia* and *Tricardia*, upon the differences in the form of the lower premolar, and finally he raised these to the rank of genera ('94^a, 74). As will be shown in a succeeding section, *Procardia* very unexpectedly proves to be a synonym of *Schistomys*, while, as already pointed out, the variations, both individual and specific, in the form of $p_{\overline{4}}$ are so great and the transitions between the extremes is so complete, that, in my judgment, it is both impracticable and unnecessary to divide the genus. *Hedimys* was established upon a single tooth, which, I am confident, is the milk premolar of *Eocardia*.

I have found great difficulty in referring the large number of specimens of *Eocardia* in the Princeton and New York collections to the species already described, because so few of them agree at all closely with the types and because they connect the supposedly distinct species by such gradual transitions. It will therefore be necessary either to increase largely the number of species, or considerably to reduce the number already named. In view of the demonstrated individual variability, reduction is undoubtedly the proper course.

EOCARDIA MONTANA Ameghino.

(Plate LXIX, Figs. 1, 1^a.)

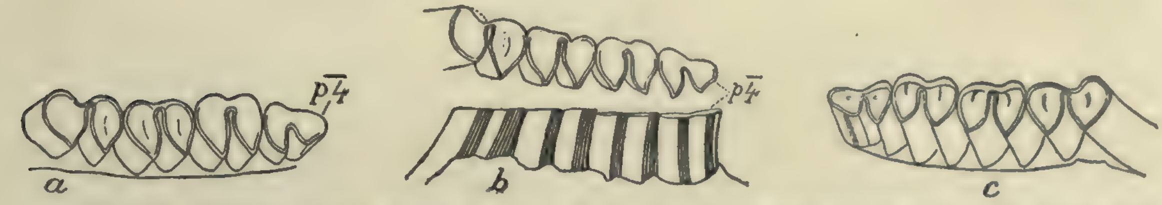
Eocardia montana Amegh.; Observ. gén. sobre el Orden de los Toxodontes, etc., La Plata, 1887, p. 65.

Dicardia maxima Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 302.

Dicardia proxima Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 74.

As this, the type species, was established upon a single tooth, which is insufficient for specific identification, it will be necessary to regard as types the individuals which Ameghino described and figured in his great work ('87^b, p. 214, Pl. X, figs. 8–11). The species is one of the larger and more robust members of the genus; the incisors are relatively large and stout and m^3 has a long, incurved posterior process. The lower premolar is very variable in form; the anterior prism may be smaller, or larger than the posterior, of elliptical, elliptico-triangular, or triangular cross-section, and with or without a groove on the anterior face; when present, the groove is shallow. In one individual (Fig. 46, *b*, A. M. N. H., No. 9,526) there is a low, but quite distinct pillar on the anterior prism, set off by a fine hairlike groove on each side of it. The mandible is stout.

FIG. 46.



Eocardia montana, lower grinding teeth, × $\frac{2}{1}$. *a.* Right side, crown view. *b.* Right side, external and crown views, A. M. N. H. *c.* Left side, crown view, A. M. N. H.

One specimen (No. 15,385) which I refer to this species, though of unusually small size, consists of a much flattened skull, lacking the cranial roof and mandible, and several fragments of vertebræ and limb-bones. The absence of the mandible makes the reference somewhat uncertain. The specimen is remarkable for the small size of p^1, for the heavy rostrum, which tapers anteriorly, and for the thickness of the zygomatic arch, especially of the zygomatic process of the maxillary.

MEASUREMENTS.	*No. 15,574.*	*No. 9,526.*	*No. 15,372.*
Lower dentition, length	.039		.039
" " " $p_{\overline{4}}$–$m_{\overline{3}}$	.019	.018	.019
Lower incisor, width	.003		.003
" " thickness	.004		.0035
$P_{\overline{4}}$, length (*i. e.*, antero-posterior diameter)	.004	.004	.004
" width (*i. e.*, transverse diameter of anterior prism)	.0025	.0025	.0025
Mandible, depth at $p_{\overline{4}}$	.010	.010	.010
" length from condyle			.050

The following measurements are from the specimen of doubtful reference, mentioned above (No. 15,385):

Upper dentition, length	.037	Palate, width at $p^{\underline{4}}$	.005
" " " $p^{\underline{4}}$–$m^{\underline{3}}$	.0165	" " " $m^{\underline{3}}$	.010
Upper incisor, width	.003	Humerus, distal width	.0095
" " thickness	.0035	" width of trochlea	.007
$P^{\underline{4}}$, length	.0025	Radius, proximal width	.006
" width	.003	Femur, " "	.018
Skull, length, occipital condyle to premaxillary	.072	" distal "	.013
Rostrum, width at base	.014	Tibia, proximal width	.015
" " " anterior end	.009	" " thickness	.012

Eocardia excavata (Ameghino).

(Plates LXVIII, Fig. 25; LXIX, Figs. 3–10.)

Dicardia excavata Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 302.

Tricardia gracilis Amegh.; Ibid.

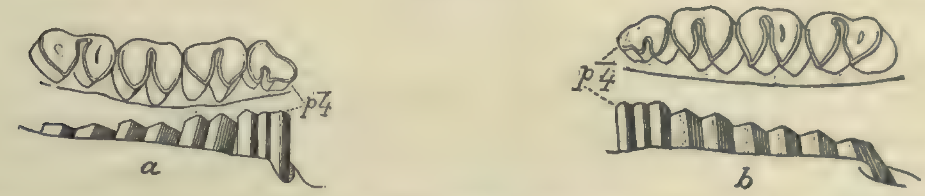
The following description is founded upon the types in the Ameghino collection and upon the most complete individual respresentative of the genus which has yet been found. This specimen (No. 15,211), a nearly entire skeleton, was collected by Mr. Hatcher on the Atlantic coast of Patagonia, ten miles south of Coy Inlet.

The average individual of this species is smaller and slighter than *E. montana*, though connecting variations in regard to size are such that the difference is by no means striking; the incisors are more slender, but $p^{\underline{4}}$ is larger, while $m^{\underline{3}}$ has a decidedly smaller posterior process. $P^{\underline{4}}$ is very variable, as is shown by the difference between the two sides of the same mandible; the anterior prism is usually, but not always, larger than the posterior and has a deep groove on the anterior face, which is sometimes so deep as to produce three well defined external, vertical crests (*Tricardia*). In No. 15,211 this groove is much better defined on the left side than on the right, and it would be no great exaggeration to say that in this individual the right half of the mandible belonged to *E. excavata* and the left to *Tricardia gracilis*.

The skull is not very completely known in this species, for in the nearly entire specimen (No. 15,211) almost the whole top of the skull has been weathered away and what remains has been considerably distorted by pressure. It is plain, however, that the skull is relatively narrower and more elongate than in *E. montana*, that the zygomatic arch, especially the ventral branch of the maxillary zygomatic process, is more slender and that the rostrum is longer and narrower. The mandible has low and narrow horizontal rami.

An account of the bones of the skeleton has already been given in the generic description, which is principally taken from this particular specimen, though in several other species more or fewer of the limb bones have been obtained and serve for purposes of comparison. Aside from the size and slenderness of the bones in this species, the only character which should be emphasized is the stoutness of the fibula, which has a thicker shaft than in *E. perforata*.

FIG. 47.



Eocardia excavata, lower grinding teeth, external and crown views, × $\frac{2}{1}$. *a.* Right side. *b.* Left side of same individual (No. 15,211).

In the following table all the dimensions are taken from the skeleton, No. 15,211.

MEASUREMENTS.

Upper dentition, length $p^{\underline{4}}$–$m^{\underline{3}}$	.017
Upper incisor, width	.0025
" " thickness	.003
$P^{\underline{4}}$, length (*i. e.*, antero-posterior diameter)	.003
$P^{\underline{4}}$, width (*i. e.*, transverse diameter)	.0026
$M^{\underline{3}}$, length	.005
" width	.004
Lower dentition, length	.0345
" " " $p_{\overline{4}}$–$m_{\overline{3}}$	.0175
Lower incisor, width	.0025
" " thickness	.003
$P_{\overline{4}}$, length	.0035
" width of anterior prism	.003
Occiput, height	.017
" " width at base	.022
Zygomatic arch, length	.035
Palate, width at $p^{\underline{4}}$	.0055
" " " $m^{\underline{3}}$	.008
Mandible, length from condyle	.045
" depth at $p_{\overline{4}}$	.008
Atlas, length	.010
" width	.021
Axis, length of centrum	.009
" width of anterior face	.011
" height to tip of spine	.017
Lumbars 5–8, inclusive, length	.064
Last lumbar, width of posterior face	.009
Last lumbar, width over transverse processes	?.030
Sacrum, length	.031
" width over pleurapophyses	.027
Scapula, length	.043
" greatest width	.021
" distal width	.011
Humerus, length	.052
" proximal width	.009
" distal width	.009

Ulna, length	.053
Radius, length	.041
" proximal width	.006
" distal width	.0065
Metacarpal II, length	.013
" " proximal width	.003
Metacarpal III, length	.016
" " proximal width	.003
Metacarpal IV, length	.015
Metacarpal V, length	.010
" " proximal width	.003
Pelvis, length	?.072
Ilium, length	.043
" greatest width	.014
Ischium, length	?.029
Symphysis, length	.024
Femur, length from head	.0645
" " " great trochanter	.068
" proximal width	.017
" distal width	.013
Tibia, length	.075
" proximal width	.013
" " thickness	.012

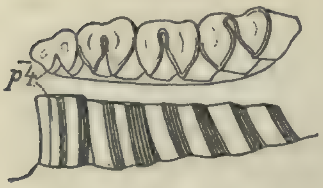
Tibia, distal width	.008
Fibula, length	.067
" distal width	.004
" " thickness	.005
Tarsus, length	.021
Astragalus, length	.011
" width of trochlea	.006
" " " distal end	.004
Calcaneum, length	.018
Metatarsal II, length	.023
" " proximal width	.0035
" " distal width	.0035
Metatarsal III, length	.024
" " proximal width	.0045
" " distal width	.0045
Metatarsal IV, length	.022
" " proximal width	.003
Digit II, phalanx 1, length	.011
" " " " proximal width	.014
" III, " " length	.013
" " " 2, length	.005
" " " 3, length	.009
" IV, " 1,	.011

EOCARDIA MODICA (Ameghino).

Dicardia modica Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 302.

It is not yet possible to determine whether this is a valid species or merely a variant, and it is therefore provisionally retained. To it I refer a mandible (A. M. N. H., No. 9,526), which agrees well with the type. In size this species is somewhat less than *E. excavata;* $p_{\overline{4}}$ has a very characteristic appearance, the anterior prism being small, perfectly triangular and with the groove of the anterior face broad and shallow.

FIG. 48.



Eocardia modica, left lower grinding teeth, external and crown views, × $\frac{2}{1}$. A. M. N. H.

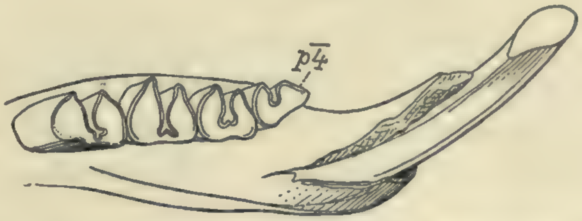
MEASUREMENTS.

Lower dentition, length $p_{\overline{4}}$–$m_{\overline{3}}$	.016
$P_{\overline{4}}$, length (*i. e.*, antero-posterior diameter)	.003
$P_{\overline{4}}$, width of anterior prism	.002
Mandible, depth at $p_{\overline{4}}$	.009

EOCARDIA PETERSONI, sp. nov.

The type of this species, a left ramus mandibuli (No. 15,323), was found ten miles south of Coy Inlet by Mr. O. A. Peterson, to whom the species is dedicated. It differs markedly from all the other species in the form of the valleys, at least in the lower teeth. In the other species the valley ends internally in a simple, narrow, cement-filled cleft, but in the present species the valley of the lower molars is divided internally into two short, divergent branches; in $m_{\overline{1}}$ and $m_{\overline{2}}$ the prominence which separates the branches is symmetrical and placed in the middle of the tooth, but in $m_{\overline{3}}$ it is asymmetrical and both branches curve forward into the anterior prism. This arrangement persists for a long time, but eventually wears away, as is evident from a comparison of the three molars. The type is from a fully adult, rather old animal and $p_{\overline{4}}$ has no indication of the divided valley. The outer edges of the prisms of the molars are set off as pillars with quite unusual distinctness.

FIG. 49.



Type of *Eocardia petersoni*, left mandibular ramus, crown view, × $\frac{2}{1}$.

The mandible is rather short and heavy, with prominent masseteric crest and external border of the masseteric fossa.

In size *E. petersoni* agrees closely with *E. montana*, but is not likely to prove a variation of that species, for none of the specimens of the latter show any tendency to vary in that direction.

MEASUREMENTS.

Lower dentition, length	.038	$P_{\overline{4}}$, length (*i. e.*, antero-posterior diameter)	.0035
" " $p_{\overline{4}}$–$m_{\overline{3}}$	.0175	$P_{\overline{4}}$, width of anterior prism	.0025
Lower incisor, width	.003	Mandible, depth at $p_{\overline{4}}$	.010
" " thickness	.0035		

EOCARDIA PERFORATA Ameghino.

(Plates LXVIII, Figs, 23–23^{e}; LXIX, 2, 2^{a}.)

Eocardia perforata Amegh.; Enumeracion sistem., etc., 1887, p. 13.
Eocardia fissa Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 146.
Dicardia fissa Amegh.; Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 74.

This species is distinguished by its smaller size and more delicate proportions. P^4 varies much in size, but has constantly a prominent anterior pillar, which is set off by grooves on each side, and is better developed than in *E. montana*, or *excavata;* the posterior process of m^3 is also variable, but is constantly smaller than in *E. montana* and may be quite rudimentary. P_4 is small, the anterior lobe smaller than the posterior and grooved, though, as usual, this groove varies much in depth and distinctness. The skull is elongate and slender, notably lighter than that of *E. montana.*

Several limb bones were found in association with one of the skulls; they resemble those of *E. excavata* in form, but are somewhat lighter and smaller; the only important difference is the greater reduction of the fibula in *E. perforata*, the shaft being extremely slender.

MEASUREMENTS.

	No. 15,010.	*No. 15,463.*
Upper dentition, length	.035	
" " " p^4–m^3	.0145	.0145
Upper incisor, width	.0025	.0023
" " thickness	.0033	.0033
P^4, length (*i. e.*, antero-posterior diameter)	.003	.003
" width (*i. e.*, transverse diameter)	.0035	.003
Lower dentition, length	.035	
" " " p_4–m_3	.015	
Lower incisor, width	.0023	.0023
" " thickness	.0025	.003
P_4, length	.003	.003
" width of anterior prism	.002	.002
Skull, interorbital width	.0165	
Rostrum, length	.019	
" width at base	.011	
" " " anterior end	.009	
Palate, width at p^4	.003	.003
" " " m^2	.0075	.007
Mandible, depth at p_4	.009	.008
Scapula, antero-posterior diameter of glenoid cavity		.007
Femur, length from head		.061
" " " great trochanter		.064
" proximal width		.015
" distal width		.012
Tibia, estimated length		.072
" proximal width		.011
" " thickness		.012

Eocardia divisa (Ameghino).

(Plate LXVIII, Fig. 24.)

Eocardia divisa Amegh.; Enumeracion sistem., etc., 1887, p. 13.
Tricardia divisa Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 302.
Tricardia crassidens Amegh.; *Ibid.*, p. 303.

The type of this species I have not seen and am therefore unable to speak confidently of its status. It is the largest known representative of the genus, the lower grinding series being 23 mm. in length. The lower incisor is somewhat longer than in *E. montana* and extends to $m_{\overline{3}}$. $P_{\overline{4}}$ appears to be constantly divided into three external crests, the anterior one of which may become a small, subcircular pillar.

SCHISTOMYS Ameghino.

(Plates LXVIII, Figs. 26–26^a; LXIX, 11–18^b.)

Schistomys Amegh.; Enumeracion sistem., etc., 1887, p. 13.
Eocardia Amegh.; in part; Rev. Argent. de Hist. Nat., T. I, 1891, p. 145.
Procardia Amegh. (subgenus); *Ibid.*, p. 302.
Procardia Amegh. (genus); Énum. Synopt. des Mamm. Foss. de Patagonie, 1894, p. 73.

This very well marked and distinct genus is closely allied to *Eocardia*, but with several important differences, which may be noted in all parts of the skeleton. The incisors tend to be heavier, though the difference is not striking; $p^{\underline{4}}$ (Plate LXIX, fig. 11^d) is molariform and is composed of two triangular prisms, which are a little thicker and separated by a somewhat shallower valley than in the molars; $m^{\underline{3}}$ is decidedly variable in form and in the size of its posterior process, which is straighter and less incurved than in *Eocardia*. In the unworn teeth the three external valleys are present, just as in the latter genus, and are soon isolated by wear as enamel lakes and then disappear altogether. All the upper grinding teeth are more strongly curved than in *Eocardia*, so that the masticating surfaces present more obliquely outward. The two dental series converge forward somewhat more strongly than in the latter, and their grinding surfaces have a forward and downward inclination, which is almost as decided as in *Dolichotis*.

The lower premolar (fig. 11^d) is, strange to say, less completely molariform than in *Eocardia;* the external valley which separates the prisms is not continued for the whole height of the crown, but is, in not very advanced stages of wear, converted into a central lake and is then worn away entirely. The molars resemble those of *Eocardia*, but, so far as I can make out, there is no cement in the valleys of either upper or lower teeth.

The milk premolars (Plate LXVIII, figs. 26–26^a) differ from those of *Eocardia* principally in being rootless; $\mathrm{dp}^{\underline{4}}$ resembles its successor, including the external accessory valleys, but $\mathrm{dp}_{\overline{4}}$ is more complex than $\mathrm{p}_{\overline{4}}$ and is much more elongate antero-posteriorly; the anterior prism is subdivided by a second external valley, which is shorter and shallower than the principal one and, in the stage figured, is reduced to a mere notch of the grinding surface.

The skull (Plate LXIX, figs. 11–12) resembles that of *Dolichotis* even more than does that of *Eocardia*, especially in the breadth of the cranium, the large size of the orbit and the manner in which the face is bent down upon the cranial axis, so that the palate is not parallel with that axis, but forms an obtuse angle with it; this flexure is, however, less than in *Dolichotis.* The occiput (fig. 12^b) is lower and wider than in the last-named genus, narrowing less toward the summit, and the foramen magnum and condyles are correspondingly lower and wider; the paroccipital processes are similar, except for being much more slender; the supraoccipital is much less extended upon the cranial roof. The parietals have much the same broad and vaulted appearance as in *Dolichotis*, but the upper contour of this region does not descend so much from the coronal suture to the occipital crest, which is principally due to the less pronounced character of the cranial flexure; the sagittal crest is relatively somewhat longer than in the modern genus, but is very low and inconspicuous. The tympanic bullæ are smaller than in the latter, especially in the transverse diameter, so that they narrow the basicranial axis less. The periotic is almost identical in shape and relations with that of *Dolichotis*, but the part left uncovered by the supramastoid process of the squamosal is somewhat larger and more inflated, and the mastoid process, though very small, is less reduced.

The squamosal, though very much like that of *Dolichotis*, differs from it in a number of details; anteriorly, it is much less extended along the floor of the orbit, and dorsally less of it appears upon the cranial roof; the supramastoid process is both longer and wider, but is less expanded at the posterior end, and there is no such groove above the root of the zygomatic process. The latter process is longer, overlapping the jugal more extensively and articulating with it by a simple, almost straight suture. The jugal is longer and narrower dorso-ventrally, but of similar laterally compressed, plate-like structure; anteriorly, it ends in a sharper point which penetrates much farther into the zygomatic process of the maxillary, but is farther removed from the lachrymal. The ventral branch of the maxillary zygomatic process is much more slender and is far more deeply notched to receive the jugal. The lachrymal is considerably smaller, but has a similar triangular shape and very low spine. The frontals are broad, moderately convex and smooth, without protuberances for the sinuses; the orbit is deep and the supraorbital border prominent and may or may not be notched; if present, the notch is much shallower than in *Dolichotis;* the postorbital process, which is incomplete in all of the skulls, may have been no longer than in the recent genus, but is more prominent, being directed outward, instead of downward. The anterior end of the frontal region has simpler sutures than in *Dolichotis* and there is hardly any nasal process. The nasals are longer than in the modern genus; in breadth and degree of convexity they differ in the various species; the anterior ends, which are not preserved in any of the specimens, were probably shaped as in *Eocardia.*

The rostrum is relatively somewhat shorter and broader and tapers less anteriorly than in *Dolichotis*, but in the proportions of the rostrum decided differences may be noted between the various species. The premaxillaries are shorter than in the existing genus, but the ascending processes, which articulate with the frontals, are longer. The maxillaries differ from those of the modern genus in several respects: the edentulous portion, in front of the grinding teeth, is longer, making up more of the rostrum, and is more deeply invaded by the much larger incisive foramina; the masseteric fossa is much deeper, though of similar shape, and the alveolus of m^3 projects less conspicuously into the orbit. The palate is less triangular than in *Dolichotis*, but rather more so than in *Eocardia*, and differs from that of the latter in having shorter palatines and larger maxillary elements. The posterior nares are wider than in *Eocardia*, with walls diverging more posteriorly; the pterygoid fossæ are large and perforated at the bottom, opening into the orbits. The alisphenoid has a broad, horizontal surface, internal to the squamosal, which differs from that of *Dolichotis* in its greater size and in the presence of a large foramen ovale, which in the modern genus has coalesced with the foramen lacerum medium.

The mandible does not differ in any important respect from that of *Eocardia*.

Two of the skulls have considerable parts of the skeleton associated with them, unfortunately including but few vertebræ and no ribs or parts of the sternum. The atlas and axis are so like those of *Eocardia* as to require no description. The lumbars are larger than in the latter and have broader spines and transverse processes, being in all respects, except for the prominence of the anapophyses, more like those of *Dolichotis*, though the neural spines are more slender and more strongly inclined forward. The sacrum differs from that of *Eocardia* only in its larger size.

The scapula (Plate LXIX, fig. 13) is not only larger than in *Eocardia*, but of a somewhat different shape, being broader in proportion to its length and with more convex coracoid and suprascapular borders; the acromion is more recurved and the metacromion more slender; the neck is more contracted; the coracoid is large and prominent, but is curved so directly inward as to be concealed when the scapula is seen from the side. In both of the Santa Cruz genera the acromion is considerably larger than in *Dolichotis*, descending below the level of the glenoid cavity.

So much of the pelvis as is preserved resembles that of *Eocardia*.

All of the limb-bones are larger than in *Eocardia*, as compared with the size of the skull, but the disparity in the length of the fore and hind limbs is even greater, a marked difference from *Dolichotis*. The humerus (Pl. LXIX, fig. 14), though very like that of *Eocardia*, differs in the less developed deltoid crest and in the wider distal end, due to the greater prominence of the internal epicondyle; in the trochlea, the median convexity for the head of the radius is shifted somewhat farther toward the outer side, and the supratrochlear foramen is larger.

Of the fore-arm bones only fragments have been obtained; these are remarkably slender and indicate that the ulna and radius could have had no such elongation as in *Dolichotis;* in shape they resemble the corresponding parts of *Eocardia*.

The femur (Pl. LXIX, fig. 15) is relatively much longer and heavier than in the other Santa Cruz genus and the great trochanter rises higher above the level of the head, which is situated upon a longer and more constricted neck. The shaft is heavy, broad and antero-posteriorly compressed.

The tibia (Pl. LXIX, fig. 16) is merely an enlarged copy of that of *Eocardia*, with somewhat straighter shaft. The fibula has a complete though very slender shaft, which is more reduced than in *E. excavata;* the distal end is shaped as in that species.

The astragalus is more asymmetrical than in *Eocardia*, owing to the larger size of the external condyle, and the distal end is broader and more depressed, an interesting approximation to *Dolichotis*. The only other elements of the pes which have yet been found are the distal half of the calcaneum and metatarsals II and III, and a few phalanges; all of these are so like the corresponding parts of *Eocardia* that description would be superfluous.

Relationships.—There can be little doubt, I think, that in *Schistomys* we have the direct ancestor of *Dolichotis*. The only objection to this conclusion that might be urged is the disparity in the length of the fore and hind limbs in the fossil. We know of no reason, however, why in the evolution of a phylum the hind limb should not first increase in size and then, at a later stage, the fore limbs lengthen equally. This same process has been observed in other phyla, notably that of the horses, in which the Oligocene *Mesohippus* shows a similar disparity that, in subsequent genera, is removed by the elongation of the fore limb, and as already mentioned, in the *Prolagostomus*—*Viscaccia* series.

SCHISTOMYS ELLIPTICUS (Ameghino).

(Plate LXIX, Figs. 11–16.)

Eocardia elliptica Amegh.; Rev. Argent. de Hist. Nat. T. I, 1891, p. 145.
Procardia elliptica Amegh.; Ibid., p. 302.
Schistomys crassus Amegh.; Ibid., p. 303.

This species is distinguished by its larger size and generally more advanced state of differentiation; in size there is considerable variation and it is evident that, as in certain existing rodents, growth continued till quite a late period in life. $P^{\underline{4}}$ is large, nearly as large as $m^{\underline{1}}$ and the grinding surface of the upper teeth has a strong inclination downward and forward. The cranium is high and vaulted, with upper contour decidedly arched in the antero-posterior direction; the supraorbital border is thin and notched. The face is strongly bent down upon the cranial axis, and the rostrum is relatively short and narrow. The limb bones have already been described.

In the subjoined table No. 9,539 is a specimen in the collection of the American Museum of Natural History.

MEASUREMENTS.

	No. 15,648.	*No. 15,420.*	*No. 15,620*	*No. 9,539.*
Upper dentition, length		.041		
“ “ “ $p^{\underline{4}}$–$m^{\underline{3}}$	.0173	.018	.017	
Upper incisor, width		.003		
“ “ thickness		.0042		
$P^{\underline{4}}$, length (*i. e.*, antero-posterior diameter)	.004	.004	.0035	
“ width (*i. e.*, transverse diameter)	.004	.004	.004	
Lower dentition, length	.039			
“ “ “ $p_{\overline{4}}$–$m_{\overline{3}}$	.019			
Lower incisor, width	.003			
“ “ thickness	.0035			
Skull, length occipital condyle to $p_{\overline{4}}$, inclusive	.049			
“ “ “ “ “ $m_{\overline{1}}$ “	.045			.052
Occiput, height	.023			.023
“ width at base	.028			.029
Tympanic bulla, length	.014			.014
Skull, interorbital width	.024	.024	.021	.022
Zygomatic arch, length	.032	.035	.037	
Rostrum, length		.023		
Palate, width at $p^{\underline{4}}$	.0035	.003	.003	
“ “ “ $m^{\underline{3}}$	.009	.009	.0095	.010
Mandible, length from condyle	.052			
“ depth at $p^{\underline{4}}$	.011			
Atlas, length				.011
“ width				.026
Axis, length of centrum				.012
“ width of anterior face				.014
Last lumbar, length of centrum				.016
“ “ width of posterior face				.013
Sacrum, width over pleurapophyses				.036
Scapula, length				.056
“ width				.035
Ilium, greatest width				.018

The measurements of limb-bones are all from No. 15,648.

Humerus, length	.062	Tibia, distal width	.010
“ proximal width	.011	Fibula, distal width	.004
“ distal width	.012	“ “ thickness	.006
“ width of trochlea	.0095	Astragalus, length	.013
Radius, proximal width	.007	“ width of trochlea	.007
Ulna, width at sigmoid notch	.0065	“ “ “ distal end	.006
Femur, length from head	.080	Metatarsal II, length	.030
“ “ “ great trochanter	.084	“ “ proximal width	.004
“ proximal width	.021	“ “ distal	.005
“ distal width	.017	Metatarsal III, length	.031
Tibia, length	.091	“ “ proximal width	.0055
“ proximal width	.0175	“ “ distal width	.007

SCHISTOMYS ROLLINSII sp. nov.

(Plate LXIX, Figs. 18–18^{b}.)

The type specimen (No. 15,969), an incomplete skull, was found by Mr. Hatcher at Lake Pueyrredon. In size, this species equals *S. ellipticus*, but differs in many other respects. The upper incisors which are displayed in the broken end of the rostrum, are remarkably thick; p$^{\underline{4}}$, though entirely molariform, is very small and m^{3} has a shorter posterior process than in the preceding species; the downward inclination of the grinding surfaces of the upper dental series is less marked, the face being less flexed upon the cranial axis; the cranium is more depressed and flattened, with less antero-posterior arching; the supraorbital border is somewhat raised and thickened, but not notched. The rostrum is long and exceedingly broad, especially on the dorsal side, narrowing on the ventral side, and the nasals are much wider than in *S. ellipticus*. The palate is slightly less triangular than in the latter and the posterior nares are not so broad and have more nearly parallel sides, being shaped more as in *Eocardia*.

MEASUREMENTS.

Upper dentition, length p$^{\underline{4}}$–m$^{\underline{3}}$	.017	M$^{\underline{3}}$, length	.0055
Upper incisor, width	.003	Skull, interorbital width	.024
“ “ thickness	.0045	Palate, width at p$^{\underline{4}}$	.004
P$^{\underline{4}}$, length (*i. e.*, antero-posterior diameter)	.0025	“ “ “ m$^{\underline{3}}$	.010
“ width (*i. e.*, transverse diameter)	.003	Rostrum, width at base	.015

This species is dedicated to my friend, Philip Asheton Rollins, Esq., of New York, whose interest in the work of Patagonian exploration has been repeatedly and most generously displayed.

SCHISTOMYS ERRO Ameghino.

(Plate LXVIII, Figs. 26–26ª.)

Schistomys erro Amegh.; Enumeracion sistem., etc., 1887, p. 13.

This species, though the type of the genus, is much less common and less well known than *S. ellipticus*, from which it is distinguished by its very much smaller size. So far, no transitional forms, tending to connect the two species, have been found and there can be little doubt that the separation is justified.

In the Princeton collection *S. erro* is represented by the crushed skull of a young individual, with the milk premolars in place and m$^{\underline{2}}$ just erupting, but still entirely unworn. The specimen is too badly damaged for any instructive comparison with the skull of *S. ellipticus*, except to note its greater relative breadth and the less triangular palate.

Associated with the skull are the distal end of the tibia, the astragalus and calcaneum; these bones differ only in size from those of *S. ellipticus*.

MEASUREMENTS.

Upper dentition, length dp$^{\underline{4}}$–m$^{\underline{2}}$	.013	Palate, width at m$^{\underline{2}}$	.010
Dp$^{\underline{4}}$, length (*i. e.*, antero-posterior diameter)	.0025	Tibia, distal width	.006
Dp$^{\underline{4}}$, width (*i. e.*, transverse diameter)	.0025	" " thickness	.006
Skull, interorbital width	.018	Astragalus, length	.009
Palate, width at dp$^{\underline{4}}$	.006	" width of trochlea	.005

PHANOMYS Ameghino.

Phanomys Amegh.; Enumeracion sistem., etc., 1887, p. 13.

This interesting genus is unfortunately known only from a few grinding teeth, which, though hypsodont, are conical and closed at the base, where the valley between the two prisms becomes very shallow and dies away. Evidently, *Phanomys* indicates the transition between the cavies of the Patagonian beds, with rooted molars, and the typical Santa Cruz forms with rootless teeth, open at the base.

The two species named differ only in size.

PHANOMYS MIXTUS Ameghino.

Phanomys mixtus Amegh.; Enumeracion sistem. etc., 1887, p. 13.

Larger, the upper teeth measuring each 3–4 by 2–3 mm.

PHANOMYS VETULUS Ameghino.

Phanomys vetulus Amegh.; Rev. Argent. de Hist. Nat., T. I, 1891, p. 146.

Smaller, upper teeth measuring 2.5 mm., each in antero-posterior diameter.

GENUS INCERTÆ SEDIS.

CALLODONTOMYS Ameghino.

Callodontomys Amegh.; Contrib. al Conoc. de los Mam. Fos. de la Repúb. Argent., 1889, p. 259; Pl. IX, figs. 27, 27^a.

This supposed genus is known only from the incisor, which is characterized by a deep groove on the *posterior* face and is not improbably pathological.

The species assigned is

CALLODONTOMYS VASTATUS Ameghino.

Callodontomys vastatus Amegh.; Loc. cit.

BIBLIOGRAPHY.

Ameghino, Florentino.

1887^a Observaciones generales sobre el órden de mamíferos estinguidos sud-americanos llamados Toxodontes (Toxodontia) y sinópsis de los géneros y especies hasta abora conocidos. La Plata, 1887.

1887^b Enumeracion sistemática de las especies de mamíferos fósiles coleccionados por Cárlos Ameghino en los terrenos eocenos de la Patagonia austral. La Plata, 1887.

1889^b Contribucion al conocimiento de los mamíferos fósiles de la República Argentina (Actas de la Academia Nacional de Ciencias de Córdoba, T. V).

1891^a Las antiguas conexiones del continente Sud Americano y la fauna eocena argentina (Revista Argentina de Historia Natural, T. I, p. 123).

1891^b Caracteres diagnósticos de cincuenta especies nuevas de mamíferos fósiles argentinos (Ibid., p. 129).

1891^d Mamíferos y aves fósiles argentinas — Especies nuevas, adiciones y correcciones (Ibid., p. 240).

1891^g Nuevos restos de mamíferos fósiles descubiertos por Carlos Ameghino en el eoceno inferior de la Patagonia austral. — Especies nuevas, adiciones y correcciones (Ibid., p. 289).

1891^h Observaciones criticas sobre los mamíferos eocenos de la Patagonia austral (Ibid., p. 328).

1893^d Nouvelles découvertes paléontologiques dans la Patagonie australe (Revue Scientifique, T. LI, p. 13).

1894^a Énumération synoptique des espèces de mammifères fossiles des formations éocènes de Patagonie (Boletin de la Academia Nacional de Ciencias en Córdoba, T. XIII, p. 259). In the citations from this paper given in the text the paging is that of the, separate edition.

1898 Sinopsis geológico-paleontológica (Segundo Censo de la República Argentina, T. I. Buenos Aires, 1898, p. 113).

1902 Notices préliminaires sur des mammifères nouveaux des terrains crétacés de Patagonie (Bol. de la Acad. Nac. de Cien. en Córdoba, T. XVII, p. 1).

Brown, Barnum.

1903 A new species of fossil edentate from the Santa Cruz formation of Patagonia (Bulletin of the American Museum of Natural History, New York, Vol. XIX, p. 453).

Burmeister, Hermann.

1870–74 Monografia de los Glyptodontes en el Museo Público de Buenos Aires (Anales del Museo Público de Buenos Aires, T. II, p. 1).

Dobson, G. E.

1882–90 Monograph of the Insectivora, systematic and anatomical. London, 1882–1890.

Flower, W. H.

1882 On the mutual affinities of the animals composing the order Edentata (Proceedings of the Zoōlogical Society of London, 1882, p. 358).

Huxley, T. H.

1865 Osteology of the genus Glyptodon (Philosophical Transactions, Vol. 155, p. 31).

Leidy, Joseph.

1855 A memoir on the extinct sloth tribe of North America (Smithsonian Contributions to Knowledge, 1853).

1860 Remarks on the structure of the feet of Megalonyx (Transactions of the American Philosophical Society, Vol. XI, p. 107).

Lindahl, Josua.

1891 Description of a skull of Megalonyx Leidyi (Ibid., Vol. XVII, p. 1).

Lydekker, Richard.

1894 The extinct edentates of Argentina (Anales del Museo de La Plata, T. III, pt. II, p. 1).

1896 A geographical history of mammals. Cambridge, 1896.

Mercerat, Alcides.

1891^d Datos sobre restos de mamíferos fósiles pertenecientes á los Bruta, conservados en el Museo de la Plata y precedentes de los terrenos eocenos de Patagonia (Revista del Museo de La Plata, T. II, p. 5).

Moreno, F. P.

1882 Patagonia, resto de un antiguo continente hoy sumerjido (Conferencias de la Sociedad Científica Argentina, Conferencia del 15 del Junio de 1882).

Moreno, F. P., & Mercerat, A.

1891 Nota sobre algunas especies de un genero aberrante de los Dasypoda (Revista del Museo de La Plata, T. II, p. 57).

Osborn, H. F.

1903 Glyptotherium texanum, a new Glyptodont from the lower Pleistocene of Texas (Bulletin of the American Museum of Natural History, New York, Vol. XIX, p. 491).

1904 An armadillo from the Middle Eocene of North America (Ibid., Vol. XX, p. 163).

Owen, Richard.

1842 Description of the skeleton of an extinct gigantic sloth, Mylodon robustus. London, 1842.

1855 On the Megatherium. — Part II. — Vertebræ of the trunk (Philosophical Transactions, Vol. 145, p. 359).

1856 The same. — Part III. — The skull (Ibid., Vol. 146, p. 571).

1857 On the Scelidothere (Ibid., Vol. 147, p. 101).

1858 On the Megatherium. — Part IV. — Bones of the anterior extremities (Ibid., Vol. 148, p. 261).

1859 The same. — Part V. — Bones of the posterior extremities (Ibid., Vol. 149, p. 809).

Reinhardt, J.

1878 Om Kjæmpendovendyret Cœlodon (Vidensk. Selsk. Skr., 5 Rækhe, naturwidenskabelig og mathematisk Afd. XII. Copenhagen).

1879 Beskriv. of Hovedskallen of Grypotherium Darwini (Ibid.).

Thomas, Oldfield.

1887 On the homologies and succession of the teeth in the Dasyuridæ, with an attempt to trace the history of the mammalian teeth in general (Philosophical Transactions, Vol. 178^b, p. 443).

1896 On the genera of Rodents, an attempt to bring up to date the current arrangement of the order (Proceedings of the Zoölogical Society of London, 1896, p. 1012).

Tornouër, A.

1903 Note sur la géologie et la paléontologie de la Patagonie (Bulletin de la Société géologique de France, 4^e série, T. III, p. 463).

Tullberg, Tycho.

1899 Ueber das System der Nagethiere, eine phylogenetische Studie. Upsala, 1899.

Winge, H.

1887 Jordfunde og nulevende Gnavere (Rodentia) fra Lagoa Santa, Minas Geraes, Brasilien. Med over Gnavernes inbyrdes Slægtskab. (E. Museo Lundi, III).

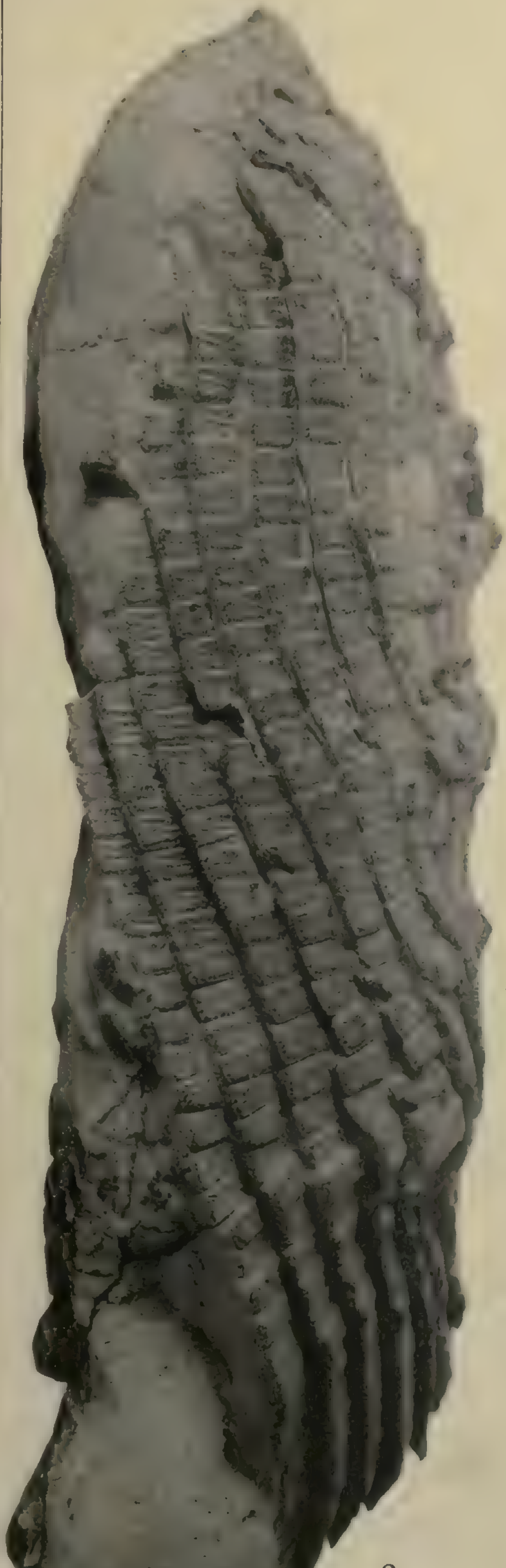
Wortman, J. L.

1896 Psittacotherium, a member of a new and primitive sub-order of the Edentata (Bulletin of the American Museum of Natural History, New York, Vol. VIII, p. 259).

1897 The Ganodonta and their relationship to the Edentata (Ibid., Vol. IX, p. 59).

ERRATA.

Page 10. Explanation of Fig. 3*d*; for right ramus *read* left ramus.
Page 104. For ? PELTEPHILUS RARUS Ameghino, *read* ? P. RARUS (Amegh.).
Page 114. For Fig. 3 *read* Fig. 13.
Page 154, line 9 (from bottom); for *Propalæohaplophorus* read *Propalæohoplophorus.*
Page 163. Explanation of Fig. 15*g*; for *Nematherium* sp. read *N. angulatum.*
Page 167. " " " 19*g*; " " " " " "
Page 167. " " " 19*e*; for *Schismotherium splendens* read *S. fractum.*
Page 173. Explanation of Fig. 25*b*; for *Analcimorphus leptocephalus* read *A. giganteus.*
Page 174. Explanation of Fig. 26*b*; for *Analcimorphus leptocephalus* read *A. giganteus.*
Page 213, line 13; for *Encholæops* read *Eucholæops.*
Page 238. For HAPALOPS INFERNALIS Ameghino, *read* H. INFERNALIS (Amegh.).
Page 239. For HAPALOPS ROSTRATUS Ameghino, *read* H. ROSTRATUS (Amegh.).
Page 241. For HAPALOPS ATLANTICUS Ameghino, *read* H. ATLANTICUS (Amegh.).
Page 241. For HAPALOPS RECTANGULIDENS Ameghino, *read* H. RECTANG. (Amegh.).
Page 242. For HAPALOPS CONGERMANUS Ameghino, *read* H. CONGERMANUS (Amegh.).
Page 243. For HAPALOPS RUETIMEYERI Ameghino, read H. RUETIMEYERI (Amegh.).
Page 251. For HAPALOPS FORTICULUS Ameghino, *read* H. FORTICULUS (Amegh.).
Page 252. For HAPALOPS GRANDIS Ameghino, *read* H. GRANDIS (Amegh.).
Page 252. For HAPALOPS LONGITUDINALIS Ameghino, read H. LONGIT. (Amegh.).
Plate VI, Explanation of Fig. 26; for No. 15,563 *read* No. 15,863.
Plate VIII, Explanation; for No. 15,597 *read* No. 15,957.
Plate XII, Explanation of Fig. 9; *add* (No. 15,433).
Plate XLVII, Explanation; for *Analcimorphus gigas* read *A. giganteus.*
Plate XLVIII, " " " " " " "
Plate XLIX, " " " " " " "



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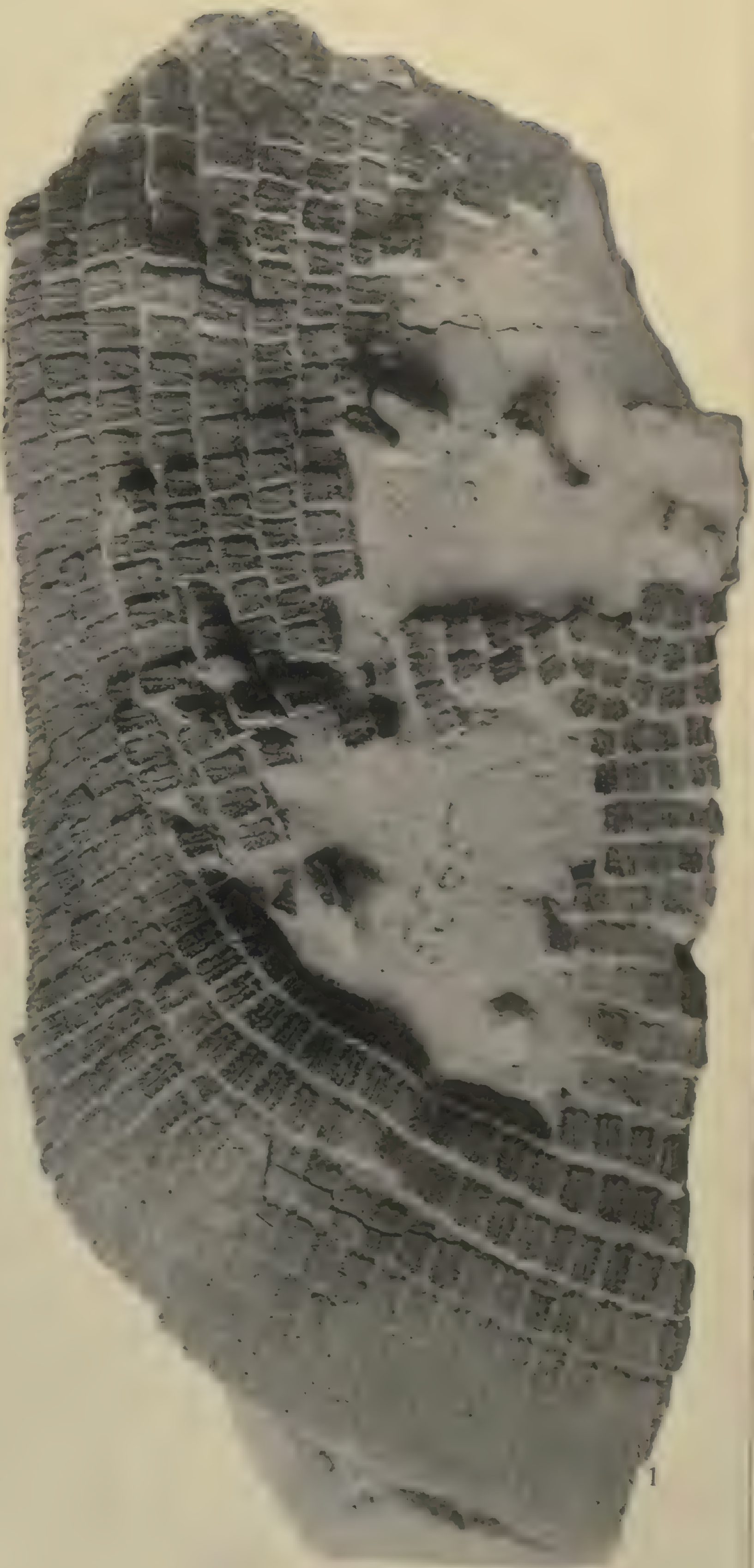

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STEGOTHERIUM

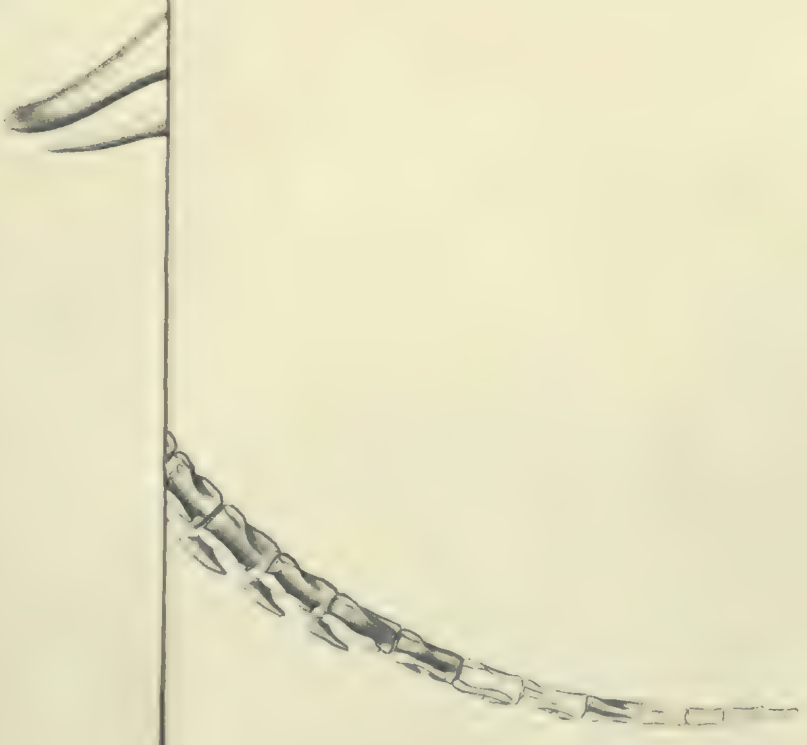
EXPLANATION OF PLATE II.

PAGE

STEGOTHERIUM TESSELATUM: Restoration of skeleton, × ½ 35

The skull, neck, 2 thoracic vertebræ and the pes are from one individual (No. 15,565) and the remainder of the skeleton from a second (No. 15,566).

PATAGONIAN EXPEDITI PLATE II



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EXPLANATION OF PLATE III.

			PAGE
Fig. 1.	Stegotherium tesselatum:	Skull, top view (No. 15,565) . . .	14
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Fig. 3.	“ “	Skull, base (No. 15,565).	
Fig. 4.	“ “	“ side view (No. 15,565).	
Fig. 5.	“ “	Skull, side view (No. 15,566).	
Fig. 6.	“ “	“ base (No. 15,566).	
		All figures natural size.	

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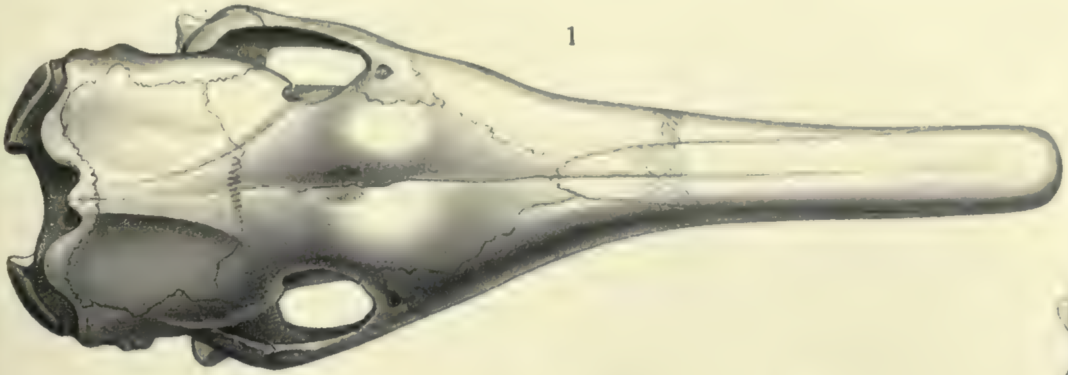

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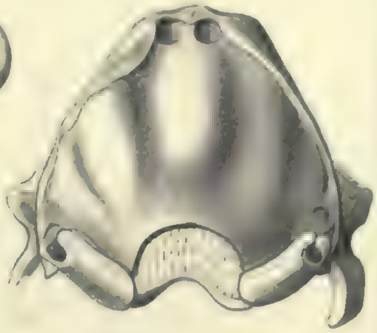

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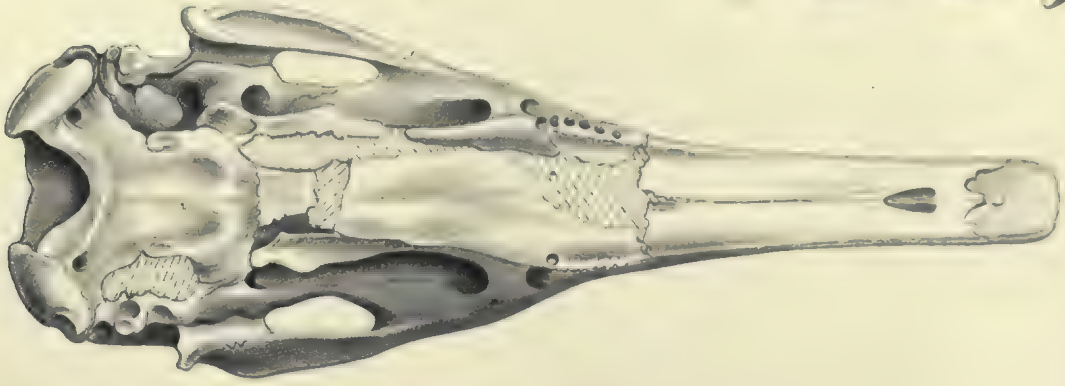

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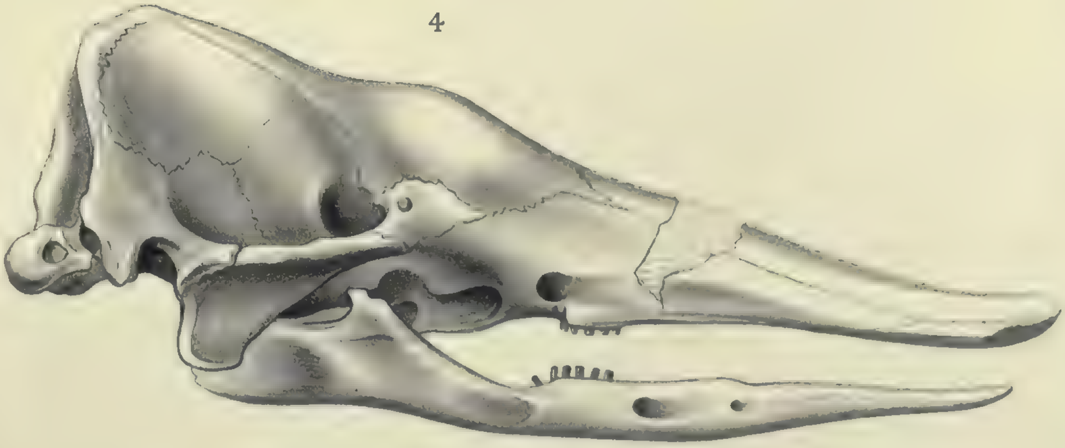

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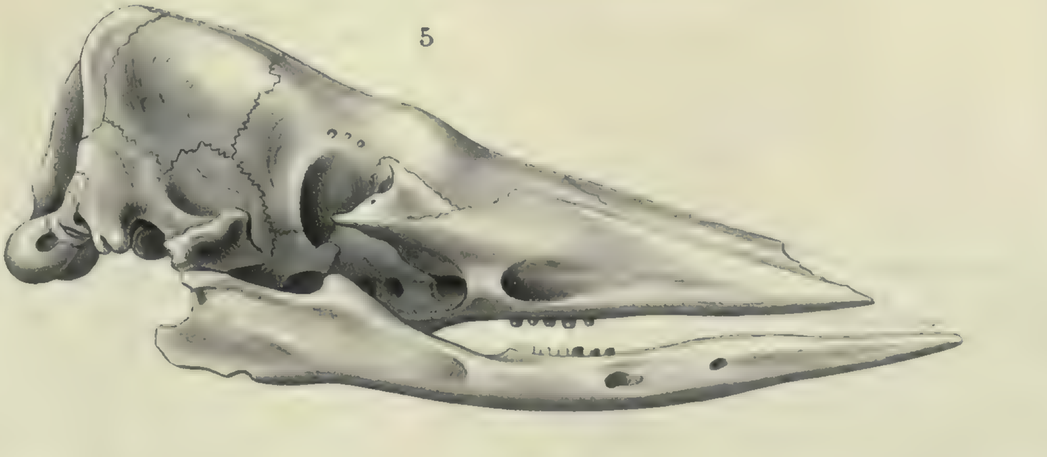

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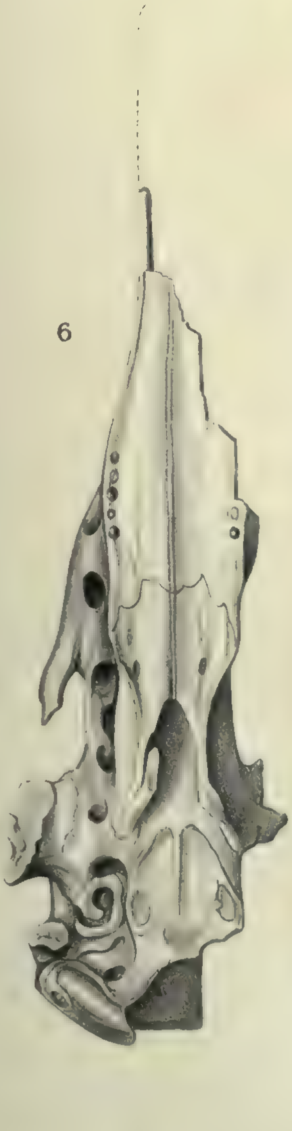

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STEGOTHERIUM

EXPLANATION OF PLATE IV.

				PAGE
Fig. 1.	STEGOTHERIUM	TESSELATUM:	Cervical vertebræ, ventral side (No. 15,565)	22
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Fig. 3.	"	"	Left scapula (No. 15,566)	28
Fig. 4.	"	"	Left humerus, from the front (No. 15,566)	29
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All figures natural size.

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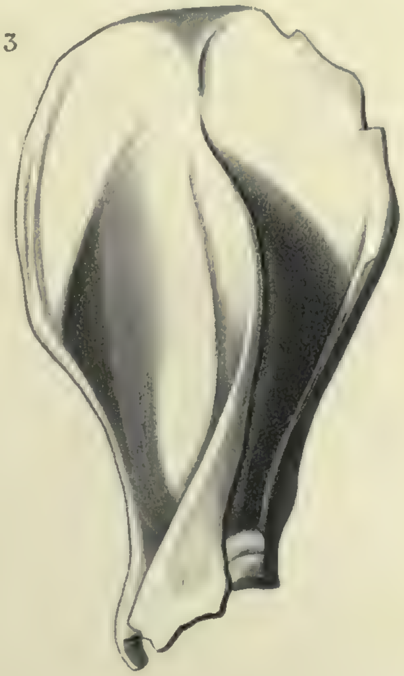

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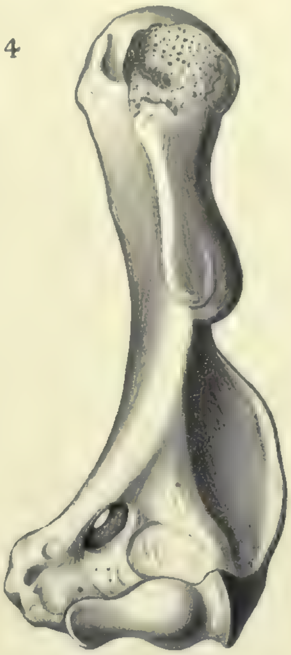

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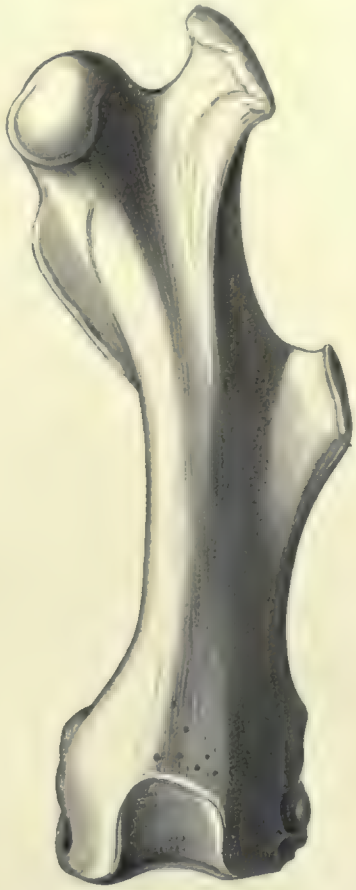

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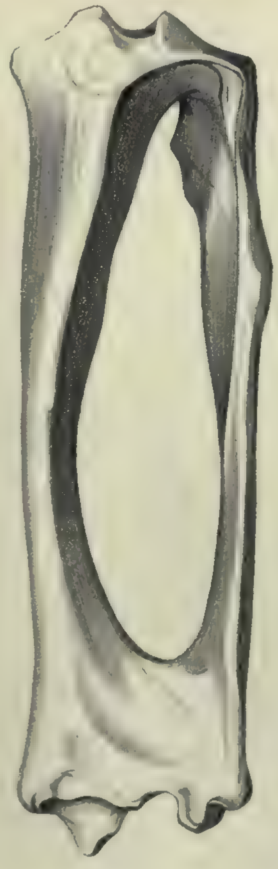

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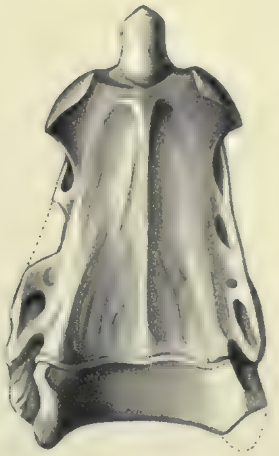

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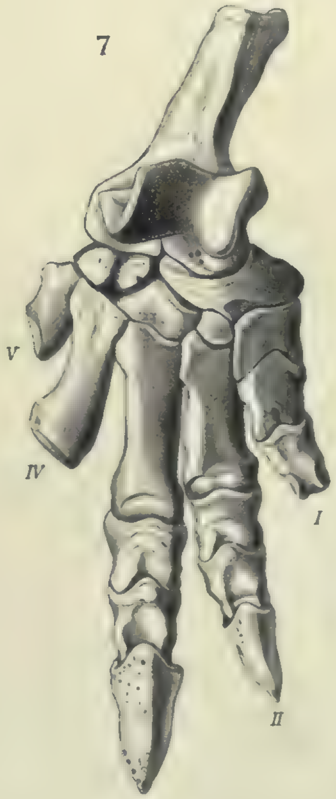

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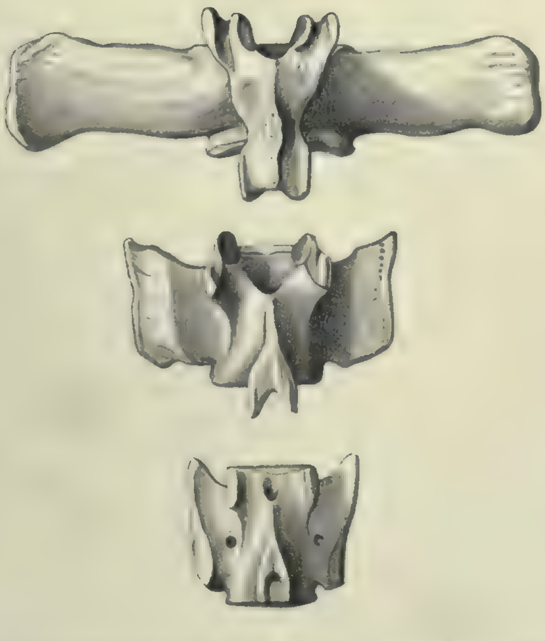

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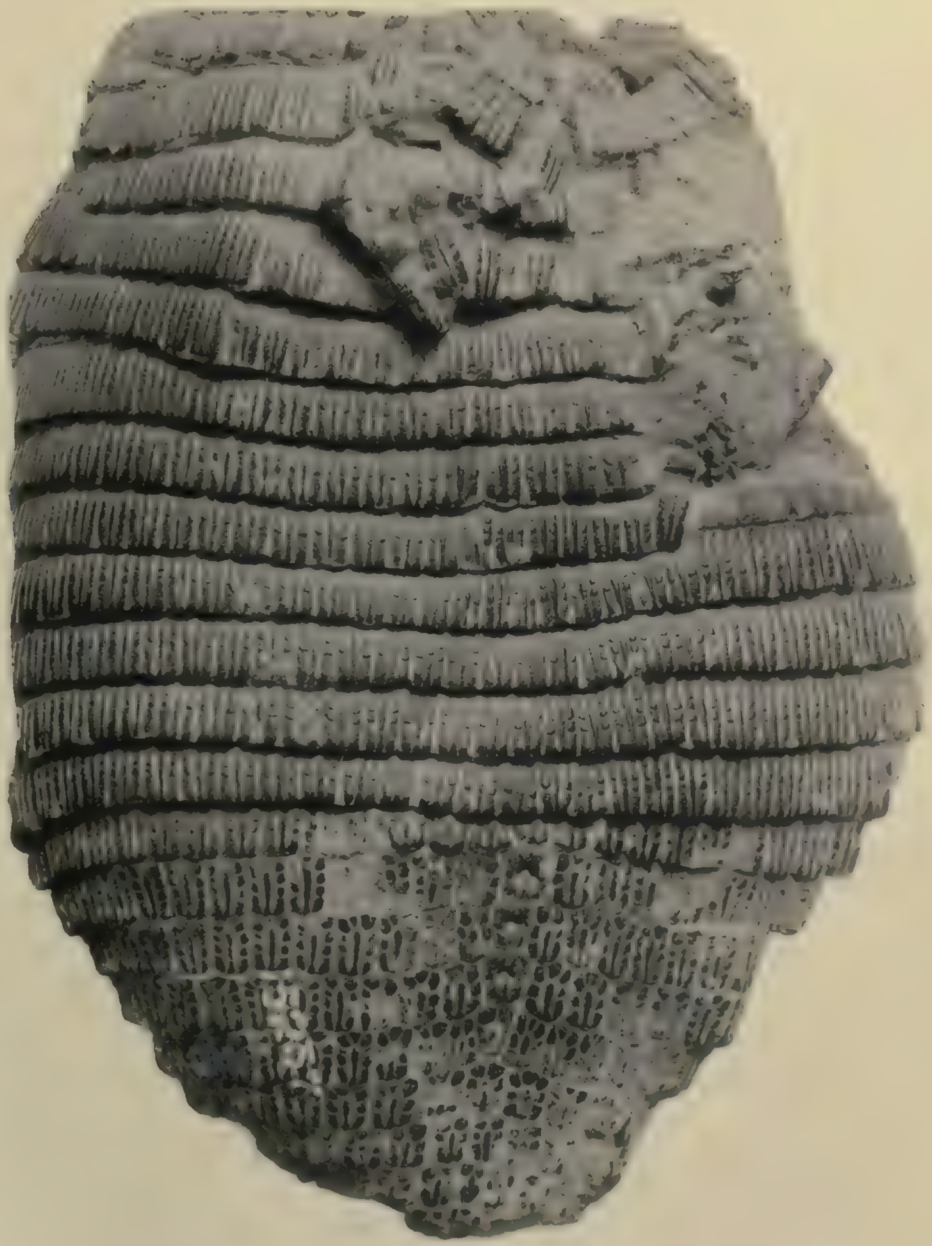
STEGOTHERIUM

EXPLANATION OF PLATE V.

	PAGE
PROZAËDIUS PROXIMUS. Carapace; natural size (No. 15,237)	78



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PROZAËDIUS

EXPLANATION OF PLATE VI.

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Fig. 2.	“ “	“ top (No. 15,579).	
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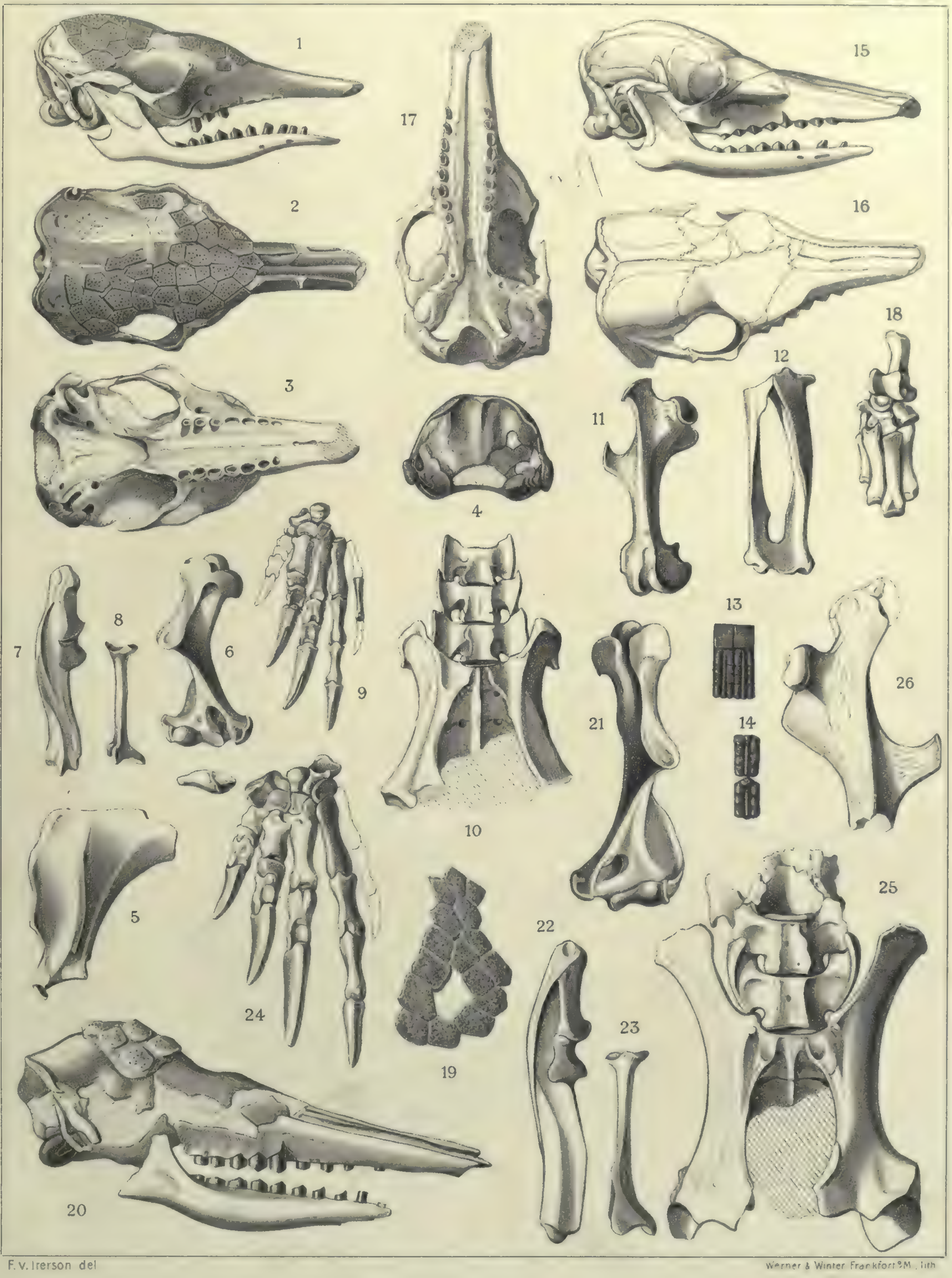
All figures natural size.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PROZAËDIUS & PRODASYPUS

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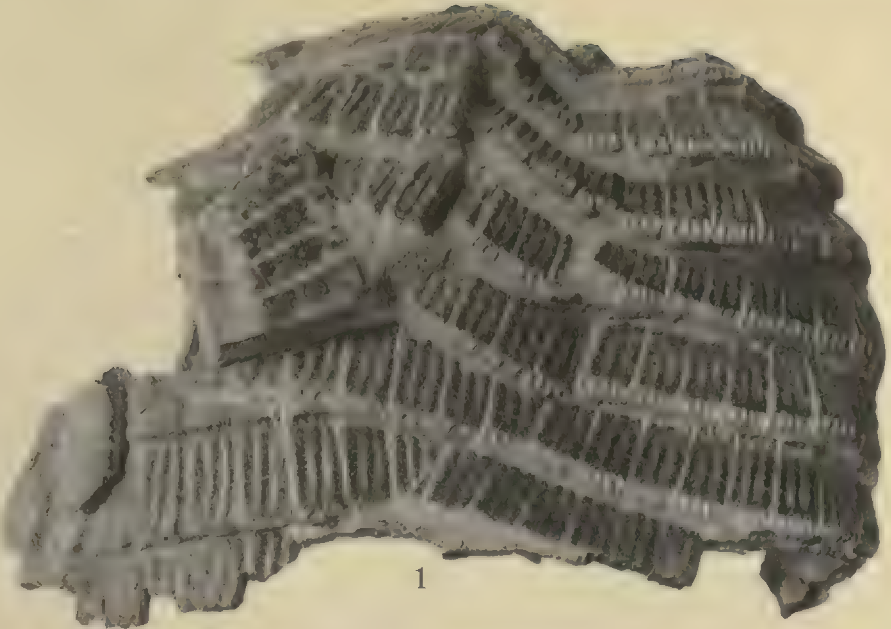
All figures natural size.



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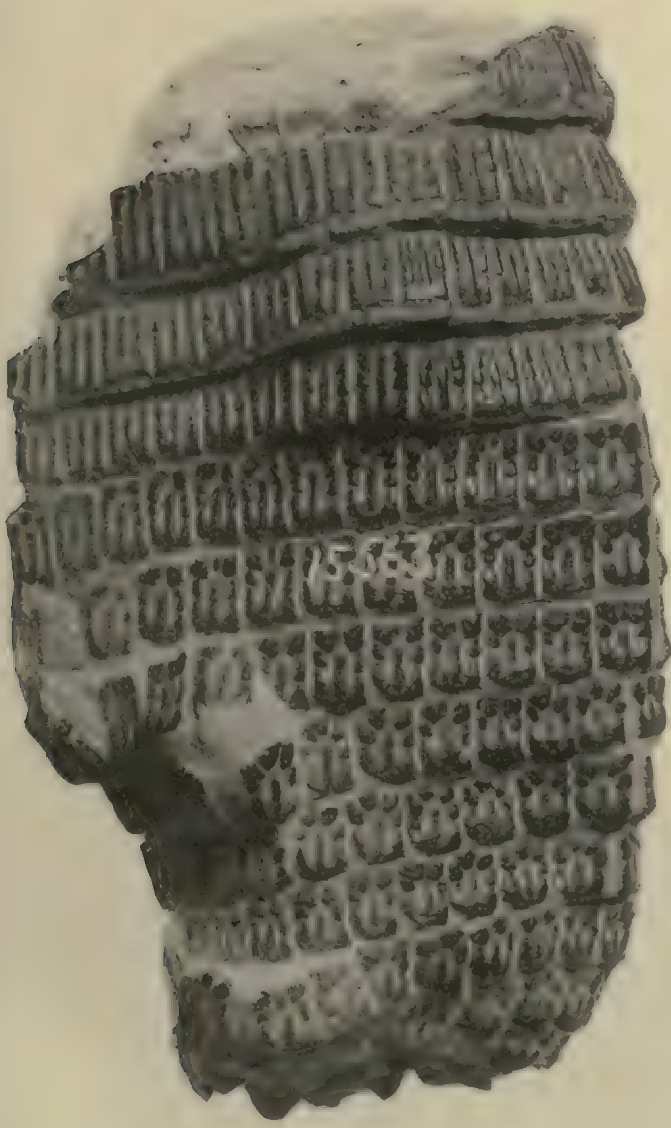

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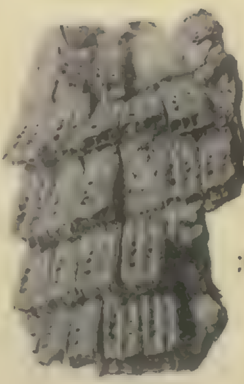

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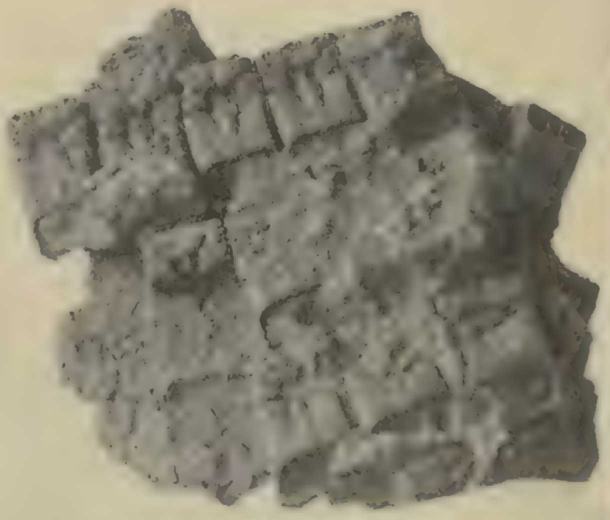

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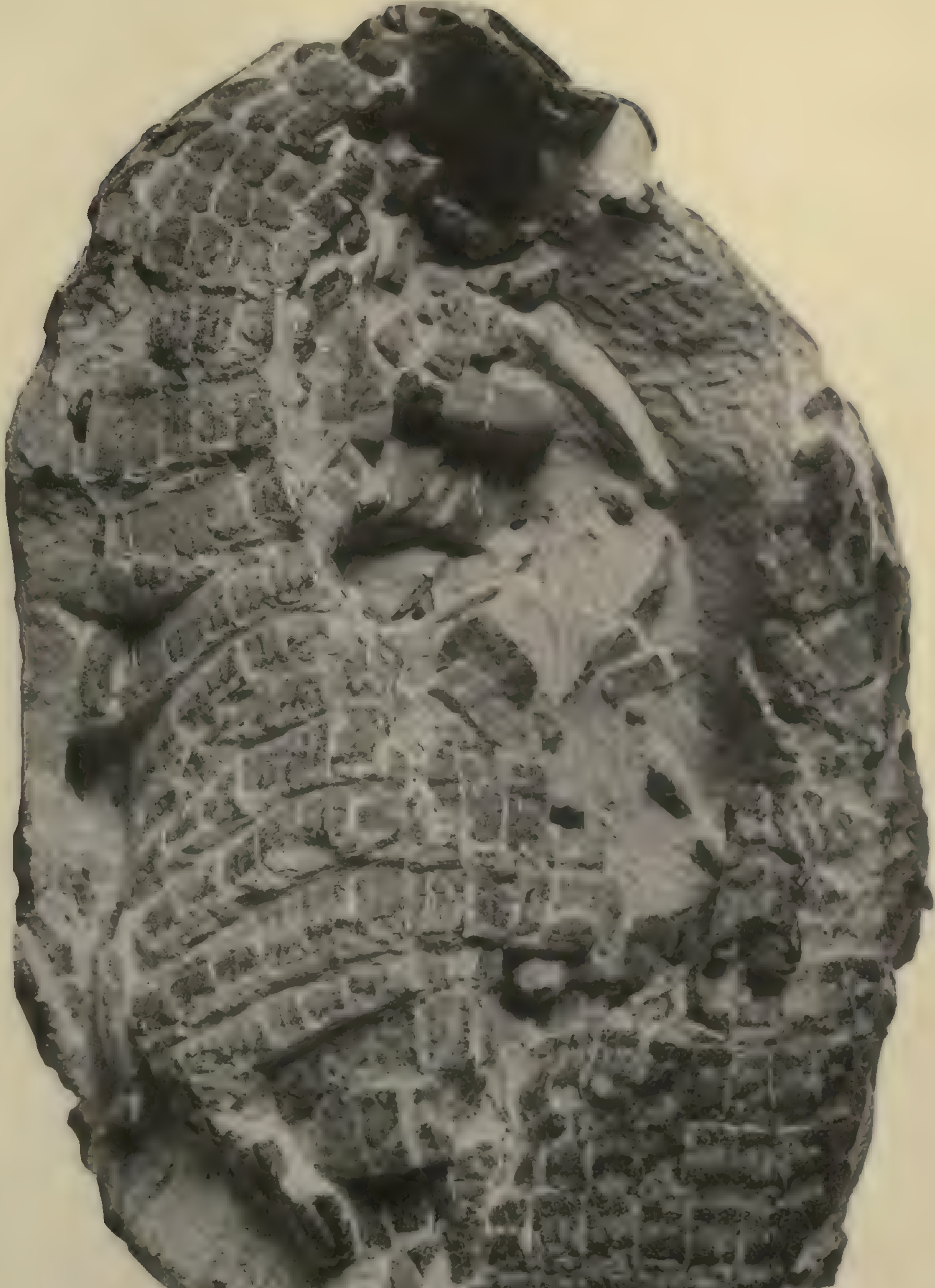
STENOTATUS & PROEUTATUS

EXPLANATION OF PLATE VIII.

	PAGE
Proeutatus robustus? carapace (No. 15,597)	43

Slightly less than three fourths natural size.



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PROEUTATUS

EXPLANATION OF PLATE IX.

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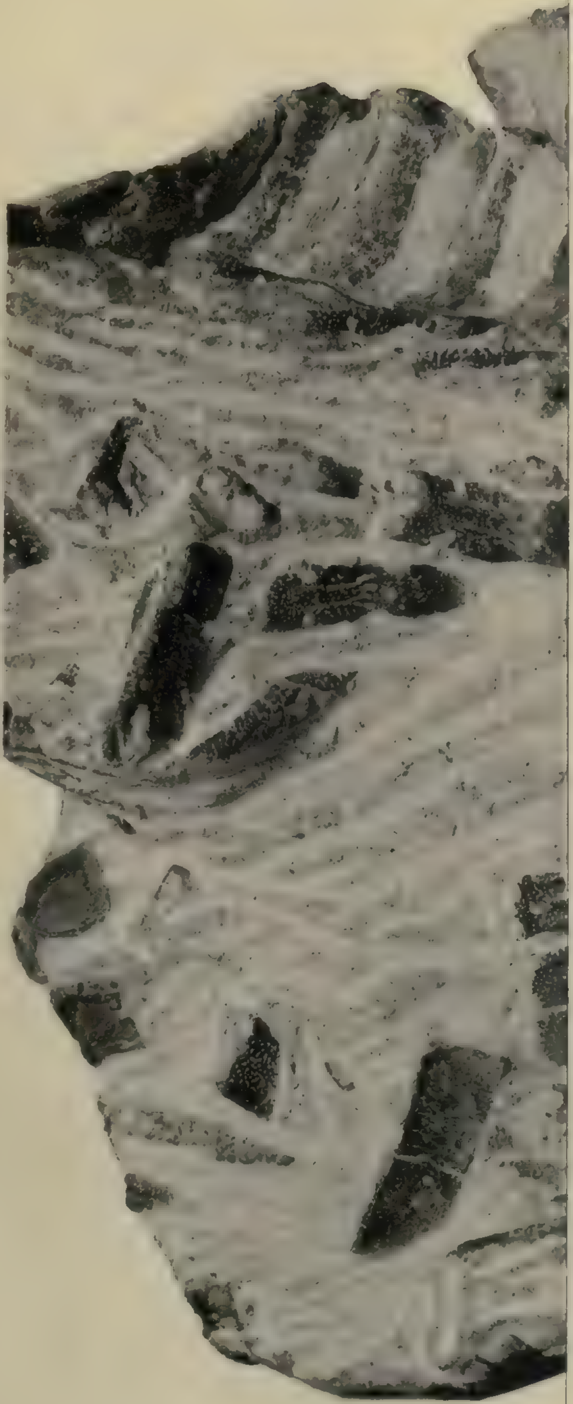

EXPLANATION OF PLATE X.

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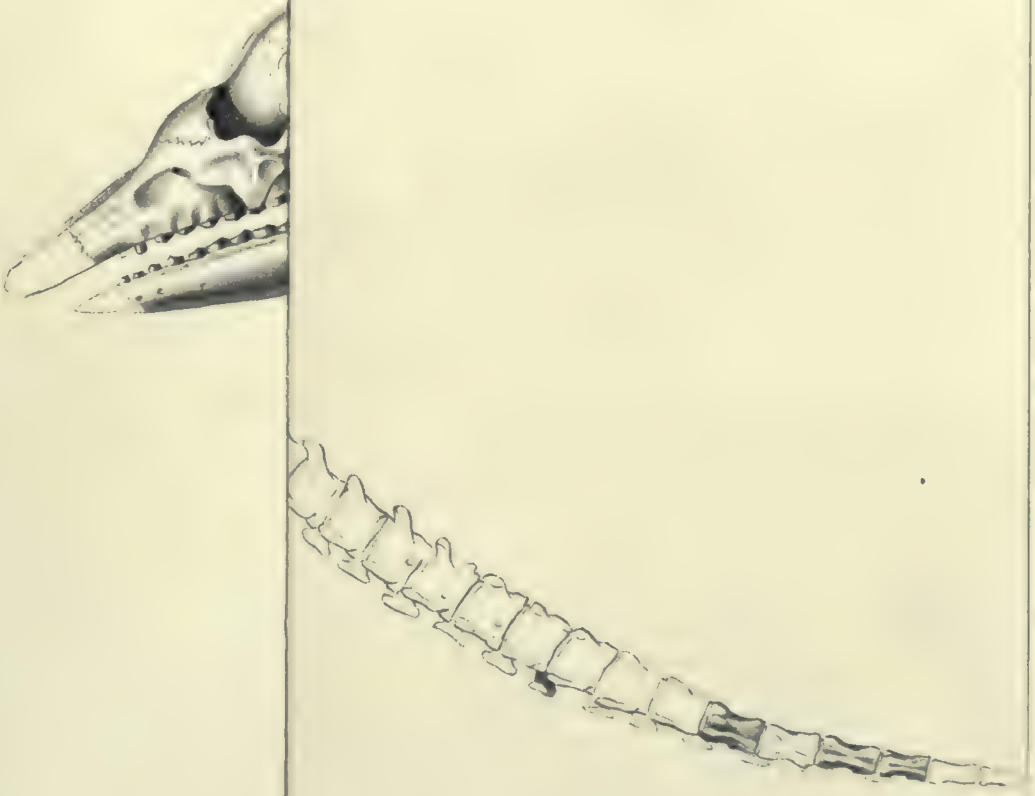
The drawing is made from the type-specimen, except the hind-limb, which is restored from other specimens agreeing with the type in size, while the pelvis is from another individual doubtfully referable to this species, and the caudal vertebræ are enlarged from those of *P. lagena.*



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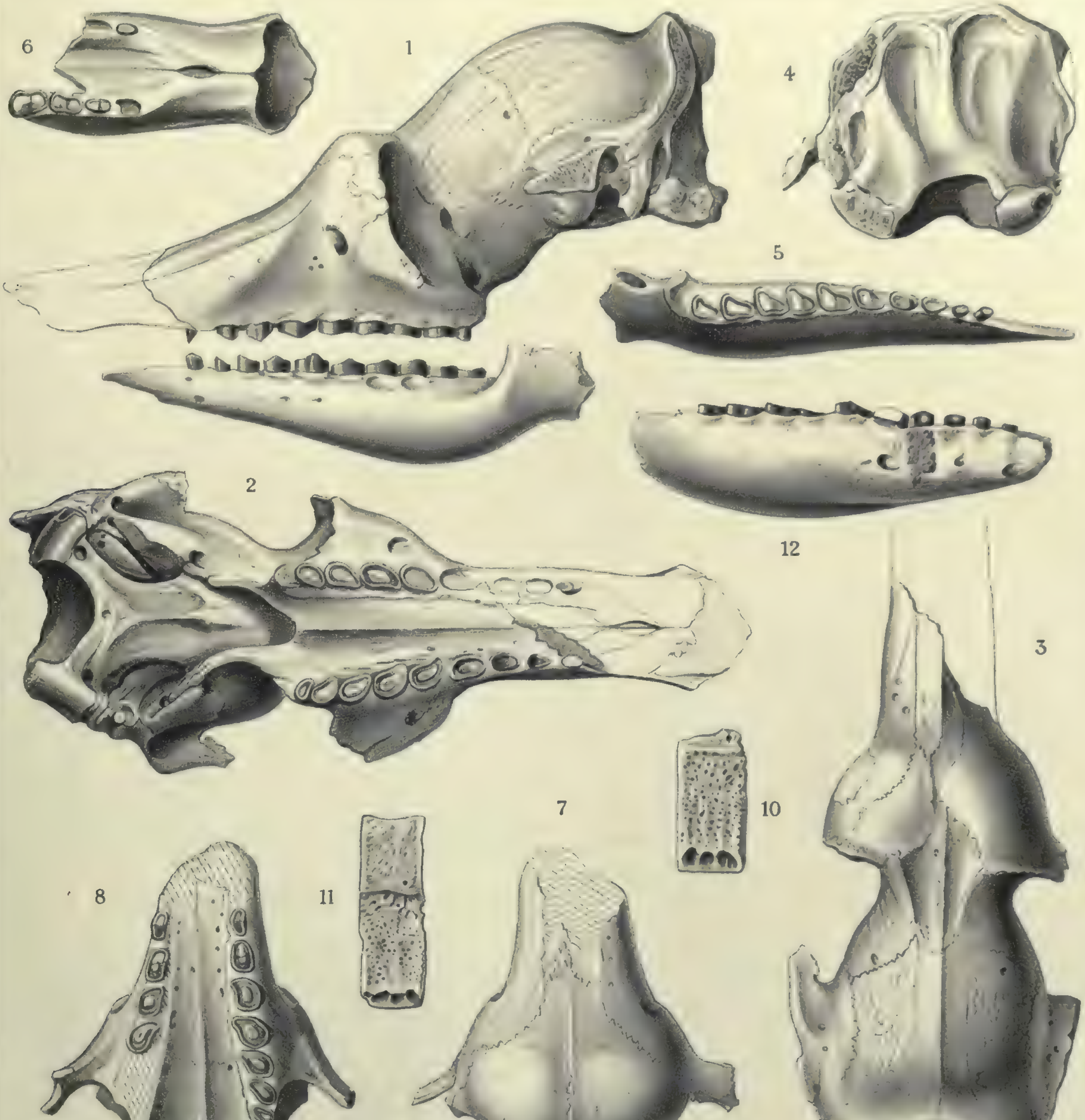
All figures natural size.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PROEUTATUS

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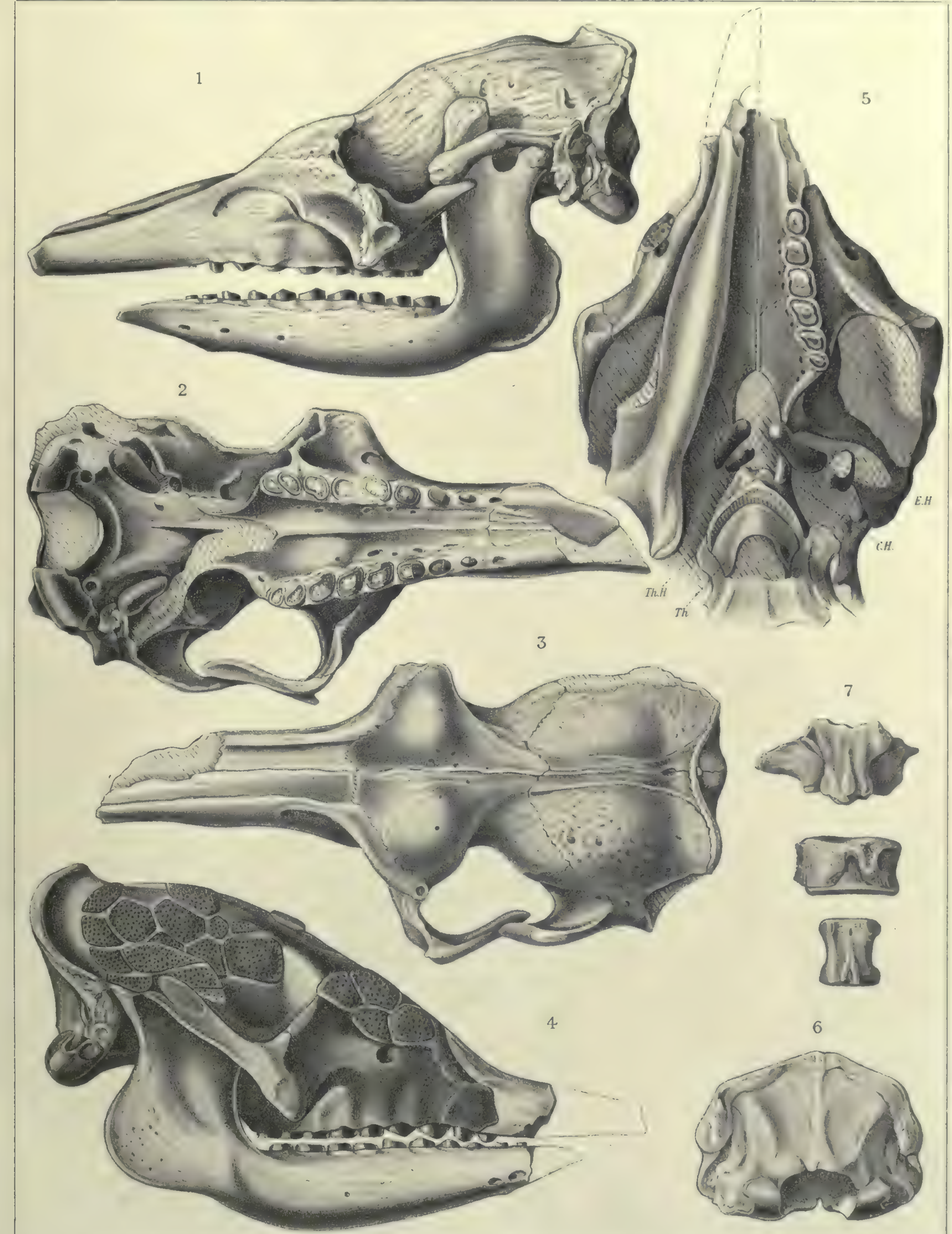
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PROEUTATUS

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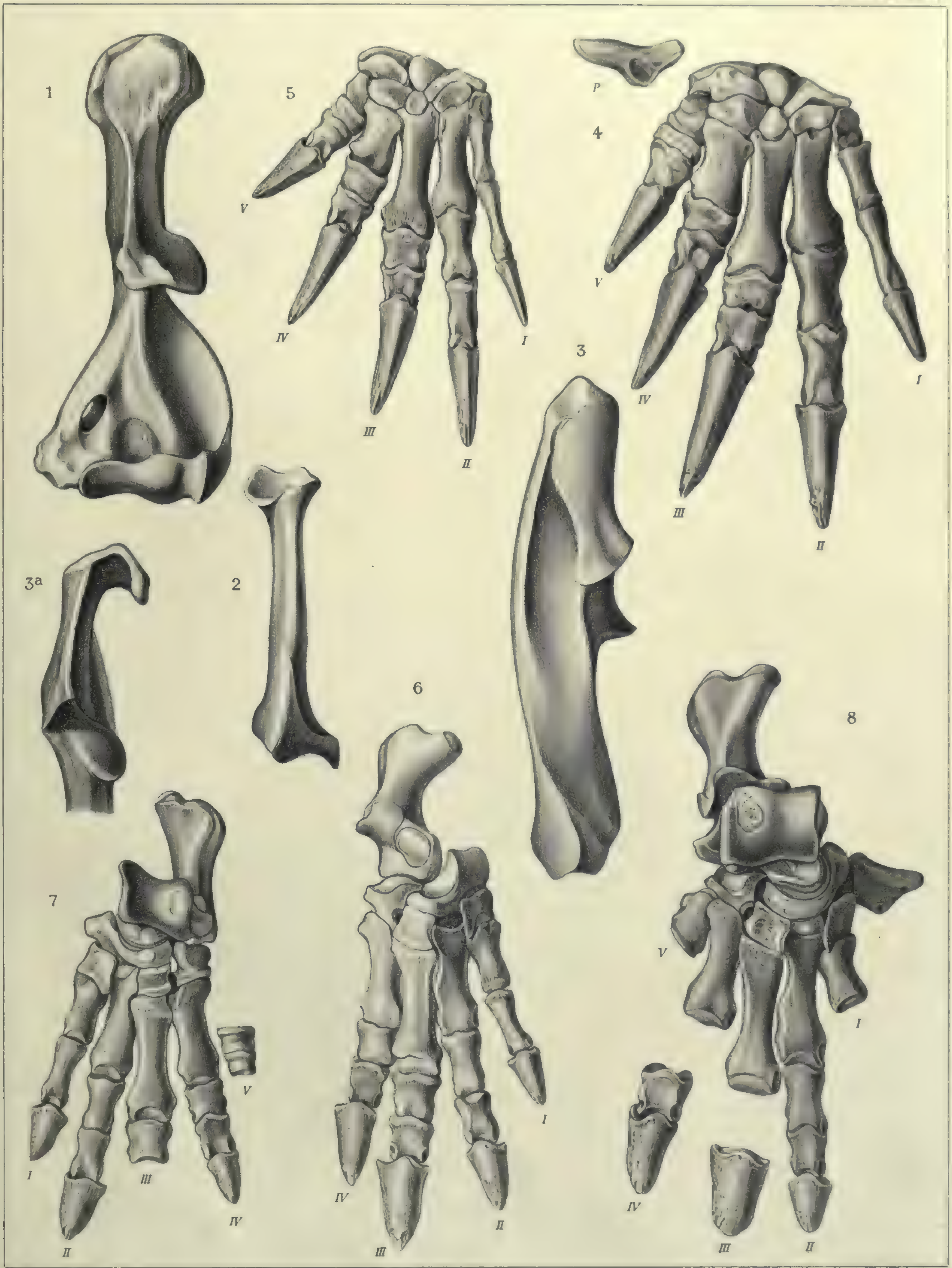
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PROEUTATUS

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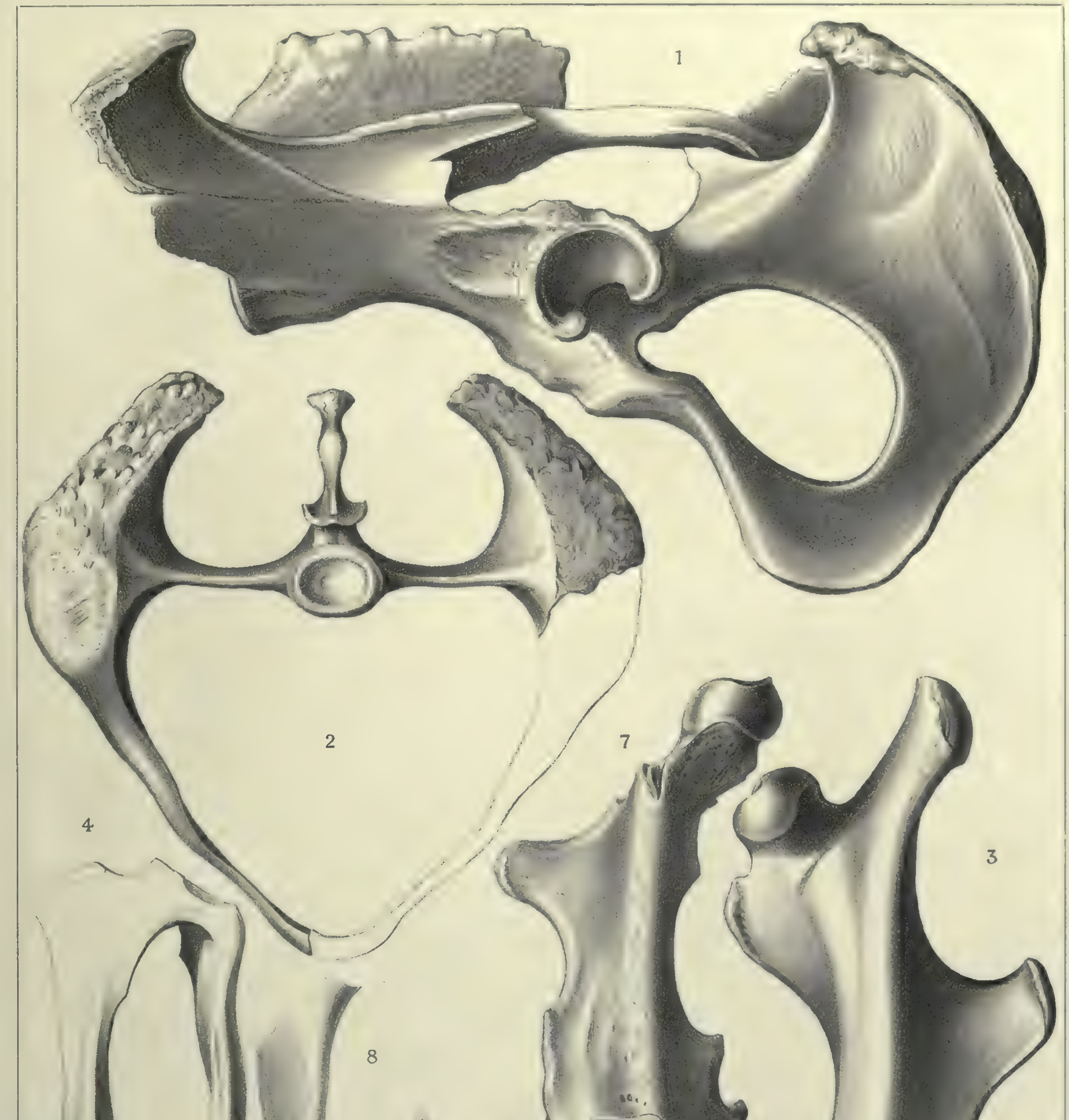

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PROEUTATUS

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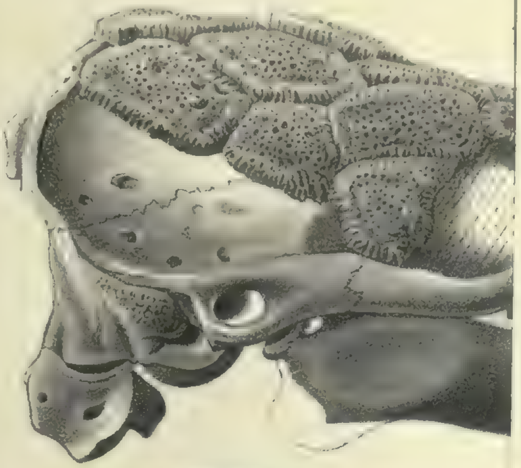

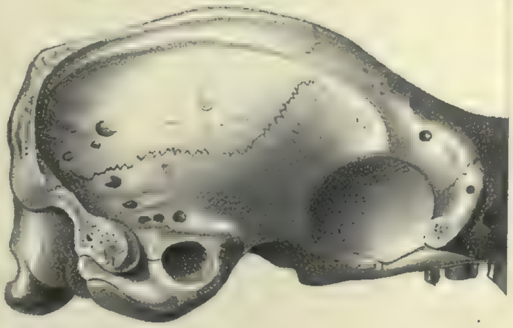

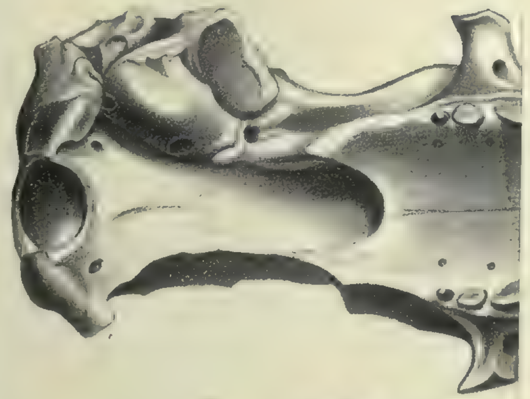

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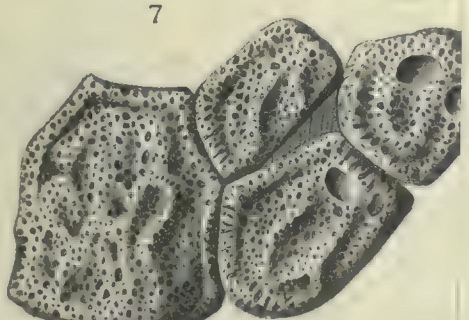

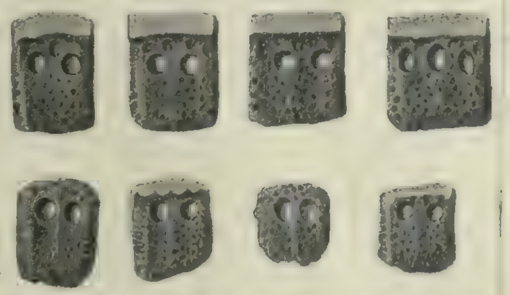

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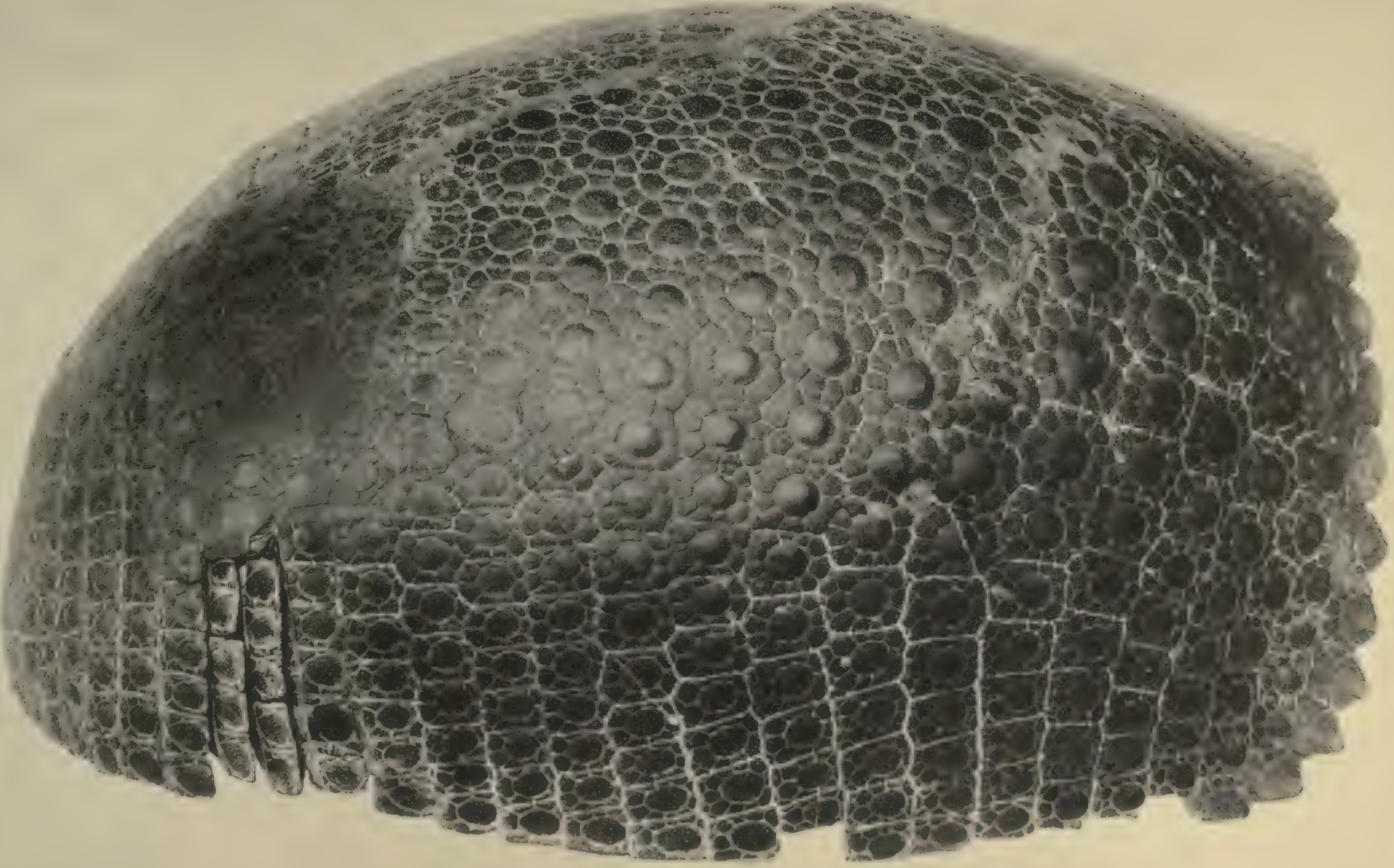
The large area above the movable bands and the posterior border above the fifth pointed marginal scute are restored, as may be seen from an examination of the surface texture.



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PROPALÆOHOPLOPHORUS

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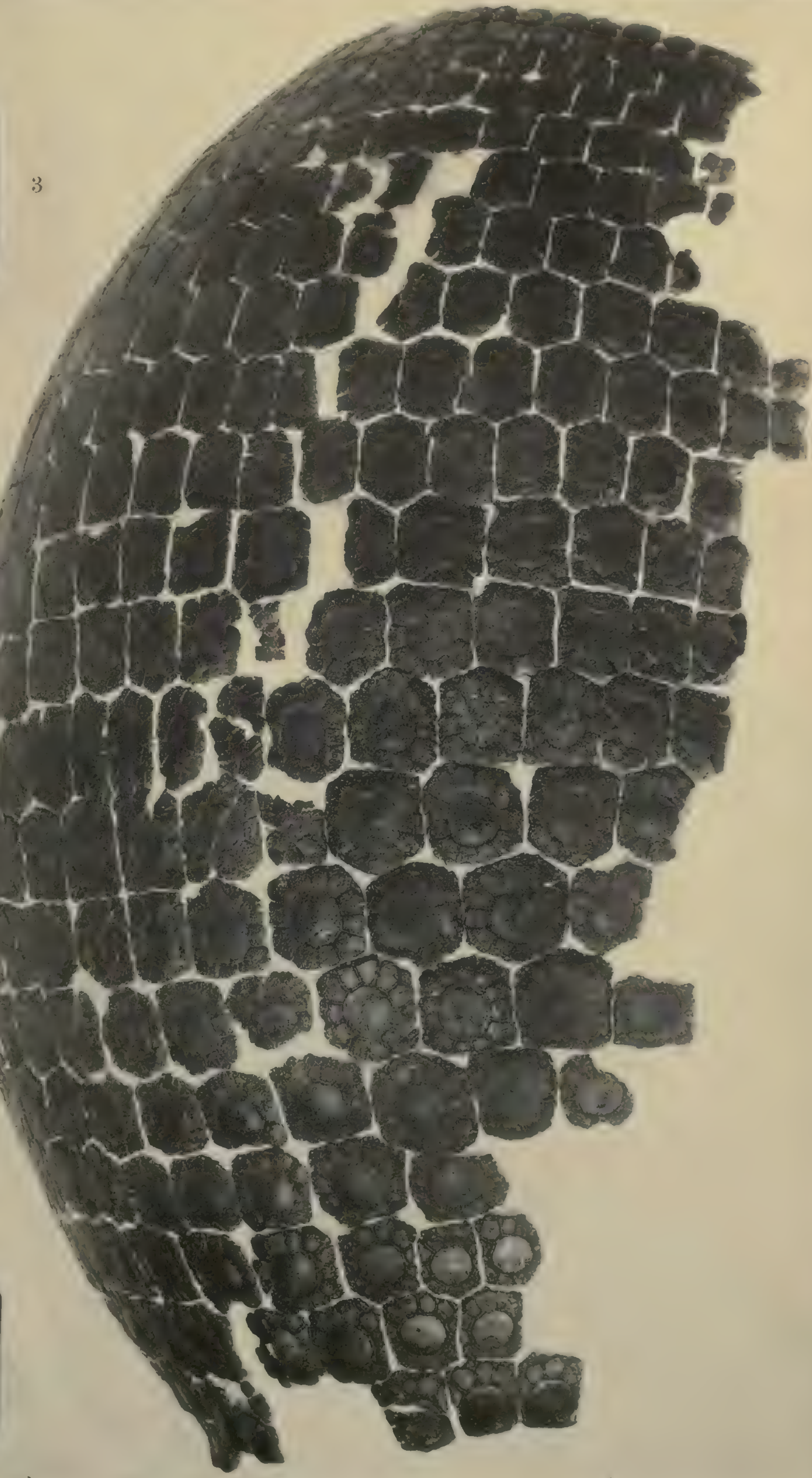

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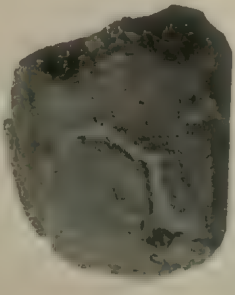

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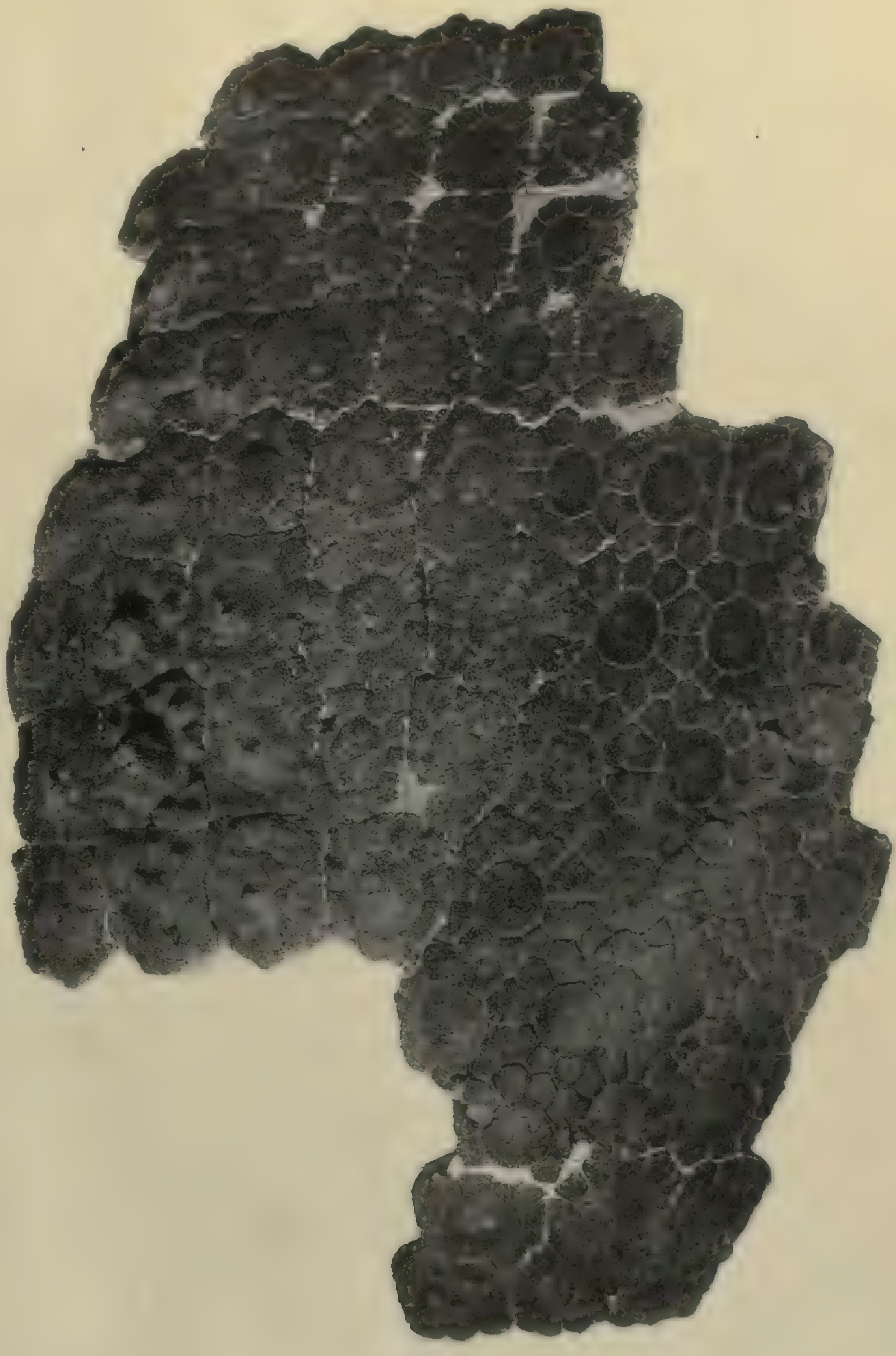

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COCHLOPS

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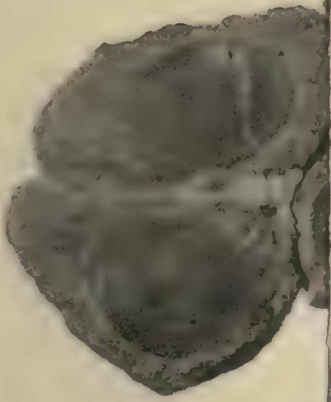
All figures, except fig. 6 natural size.



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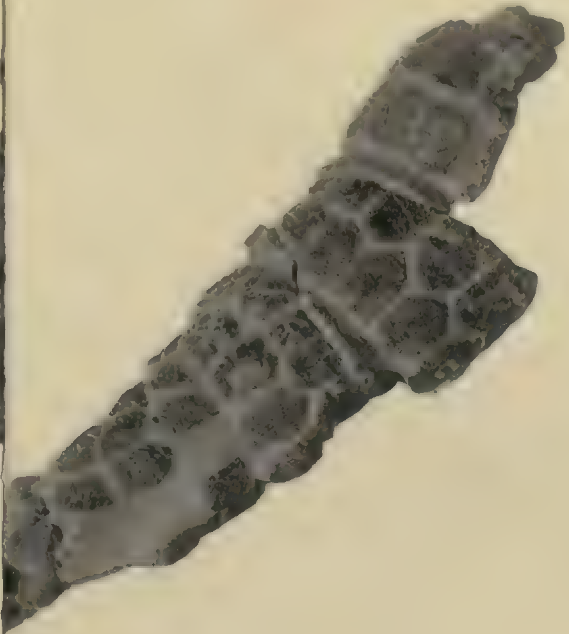

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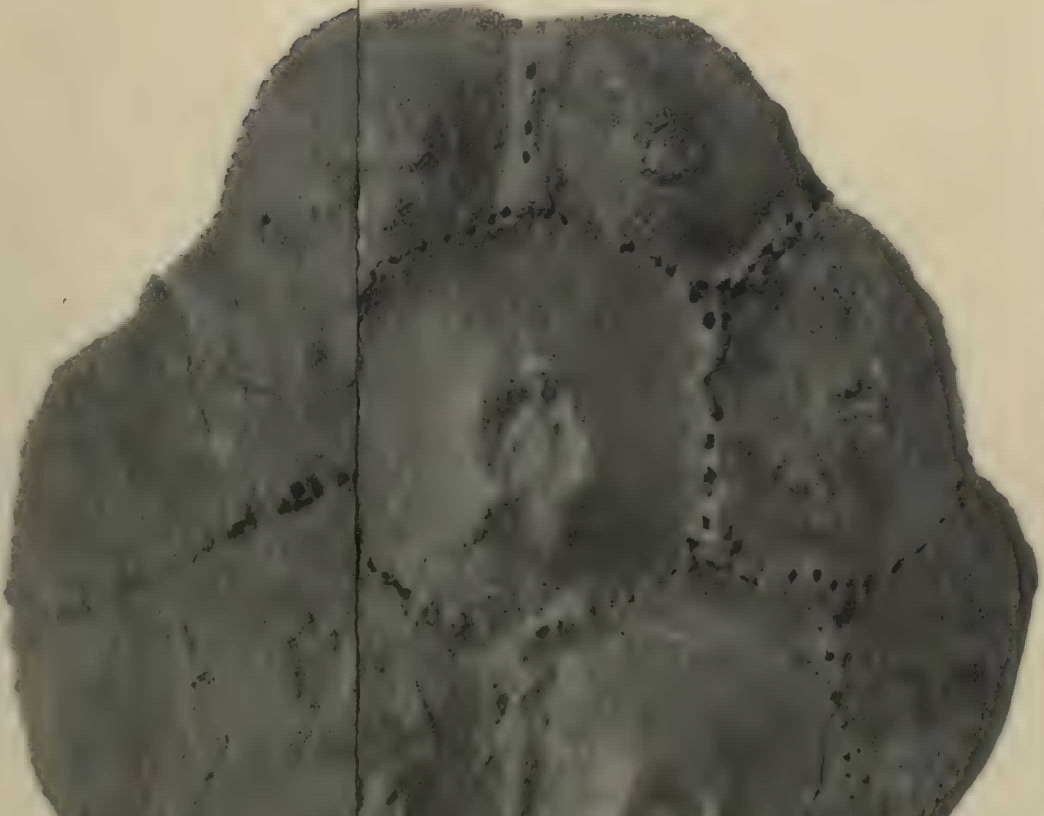

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EXPLANATION OF PLATE XXII.

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PROPALÆOHOPLOPHORUS AUSTRALIS: Restoration of skeleton, × ½ . . . 134

This figure has been made chiefly from the skeleton in the La Plata Museum, with the addition of some details from material in the Princeton and New York collections.

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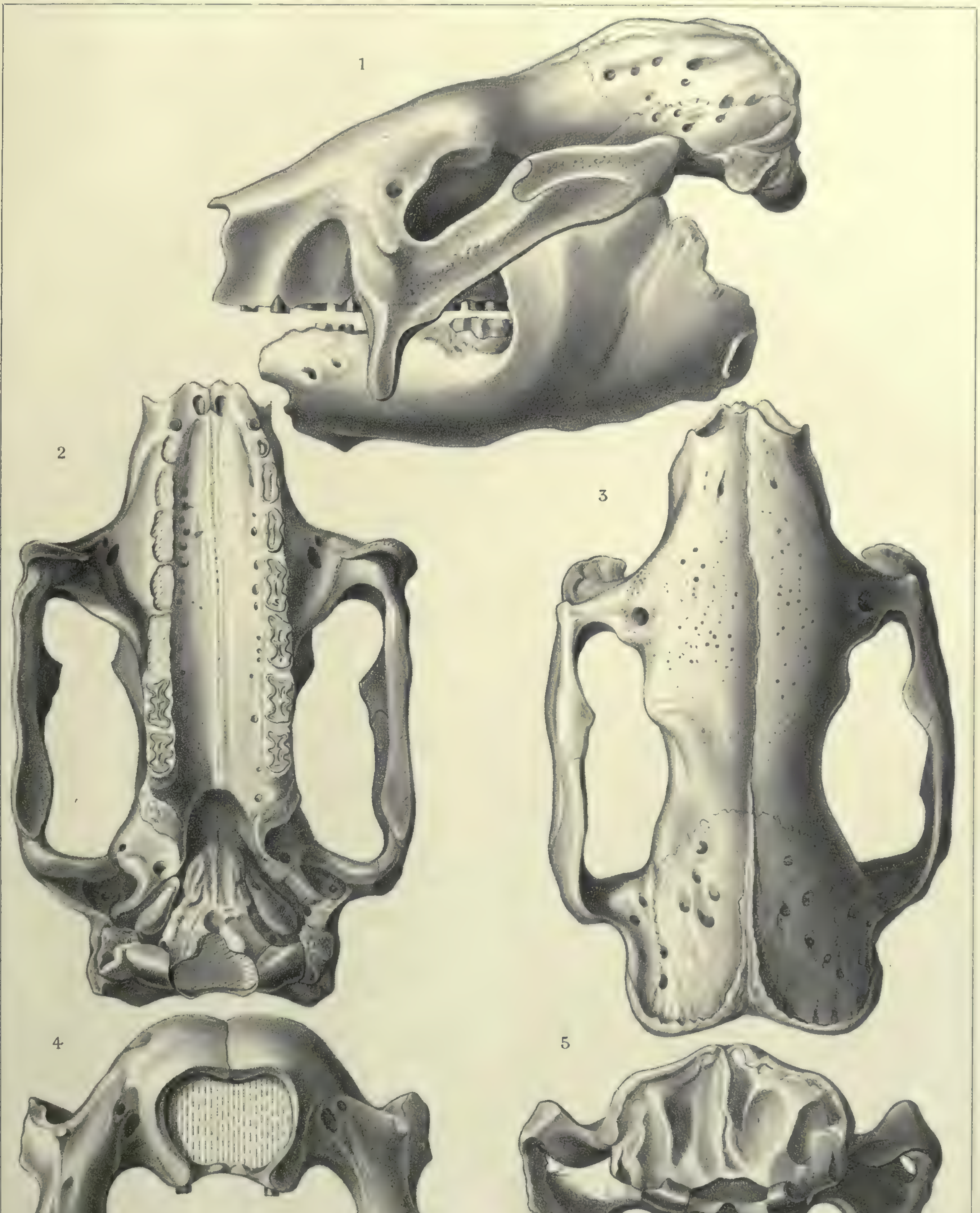
All the figures are ¾ natural size and from the same individual (No. 15,212).



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PROPALÆOHOPLOPHORUS

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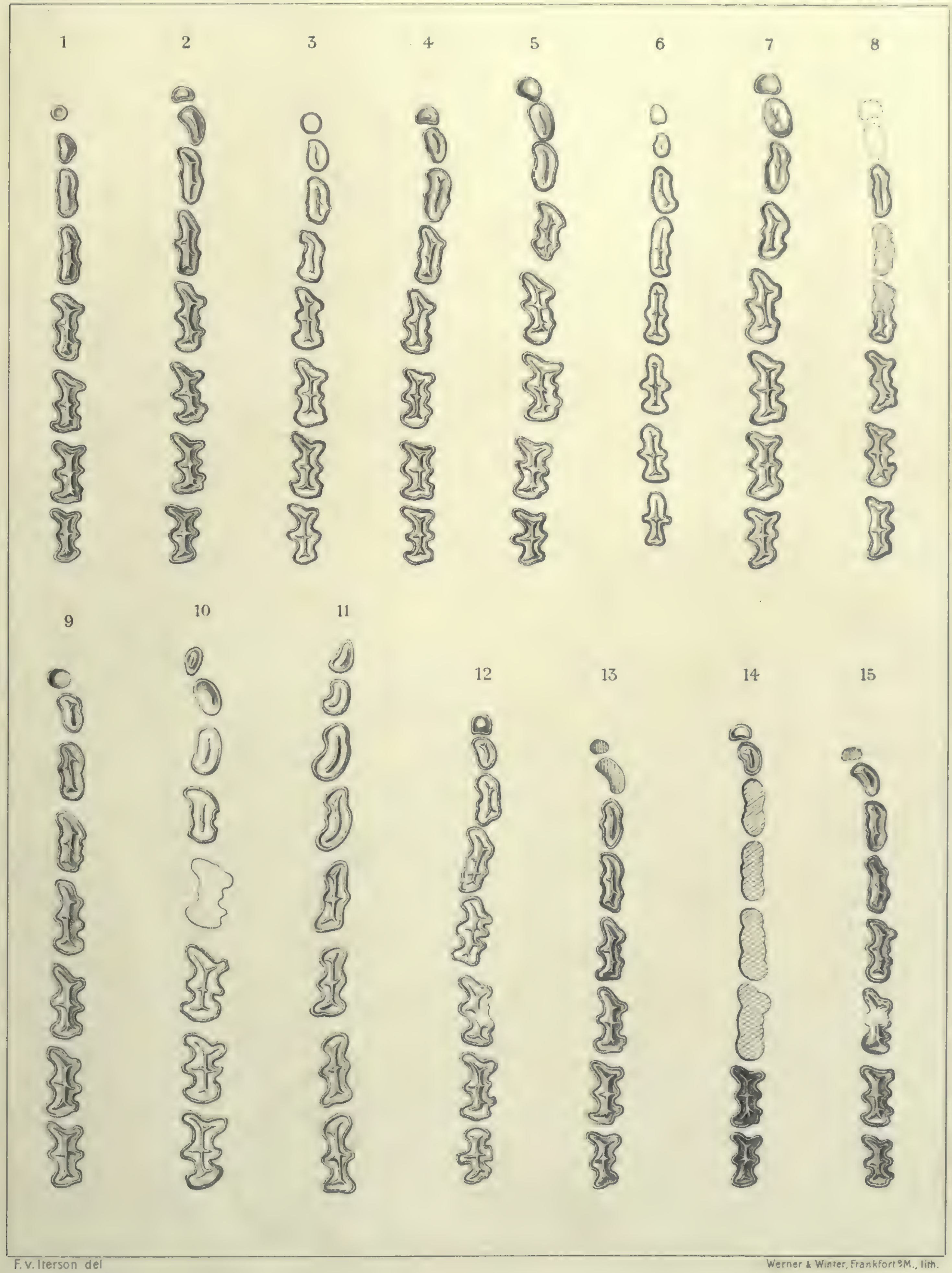
All figures natural size.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SANTA CRUZ GLYPTODONTS

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All figures ¾ natural size.

N. B. When Fig. 2 was drawn, the specimen was still partly embedded in an extremely hard concretionary matrix and the thin ridge of bone which connects the successive transverse processes was overlooked and is not shown; the pits at the base of the transverse processes should have been indicated as foramina.

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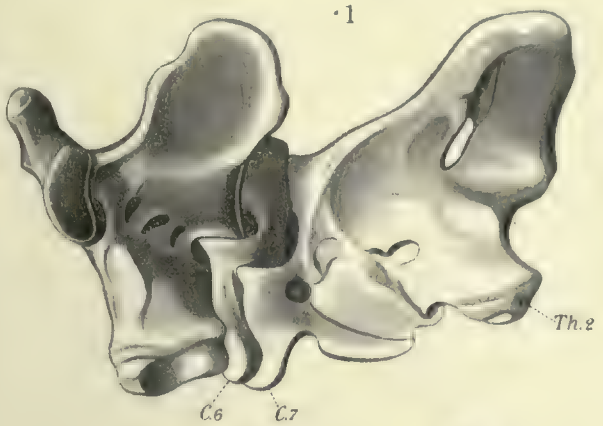

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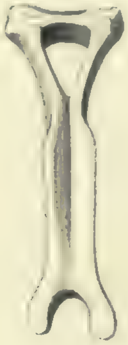

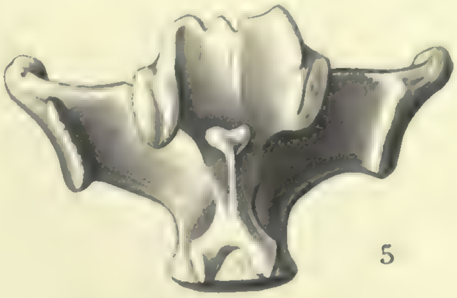

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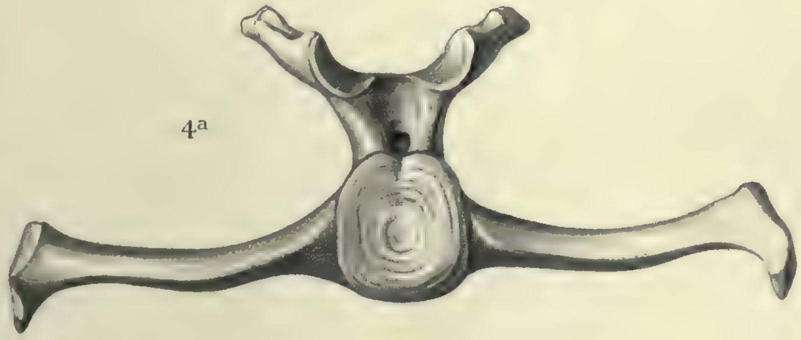

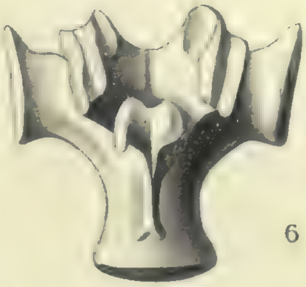

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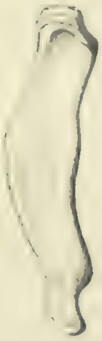

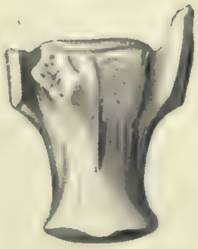

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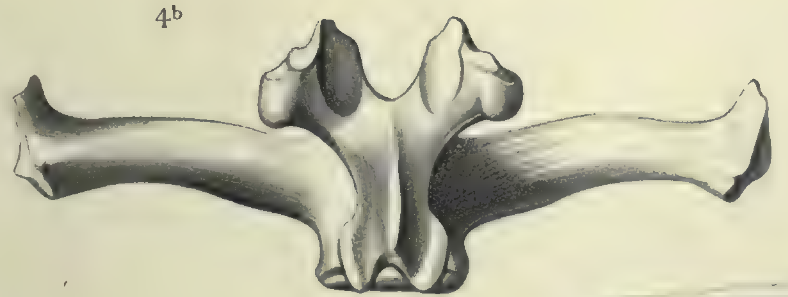

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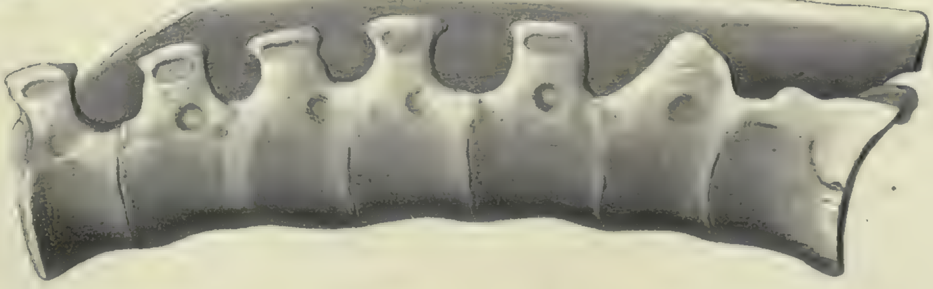

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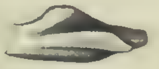

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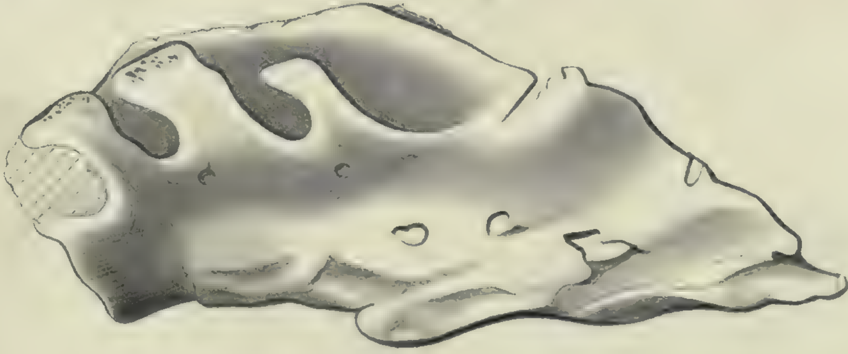

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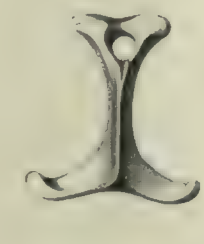

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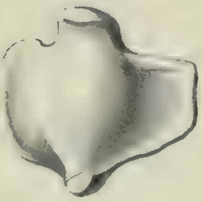

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PROPALÆOHOPLOPHORUS

EXPLANATION OF PLATE XXVI.

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All figures ¾ natural size.

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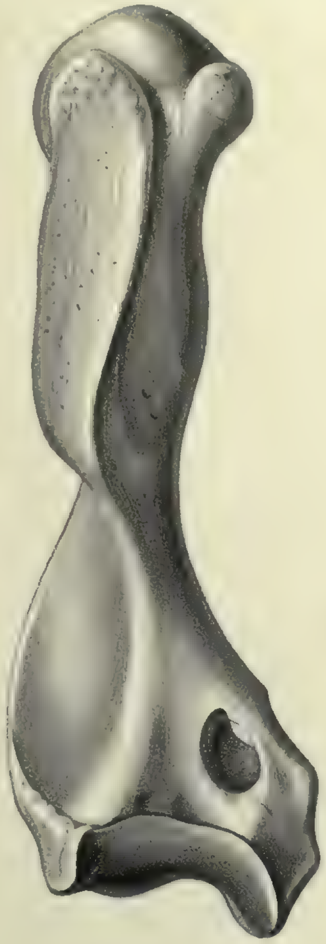

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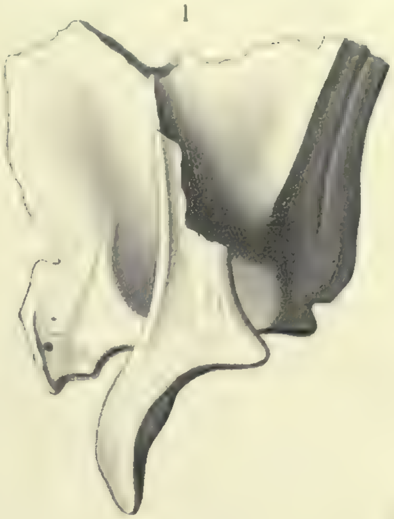

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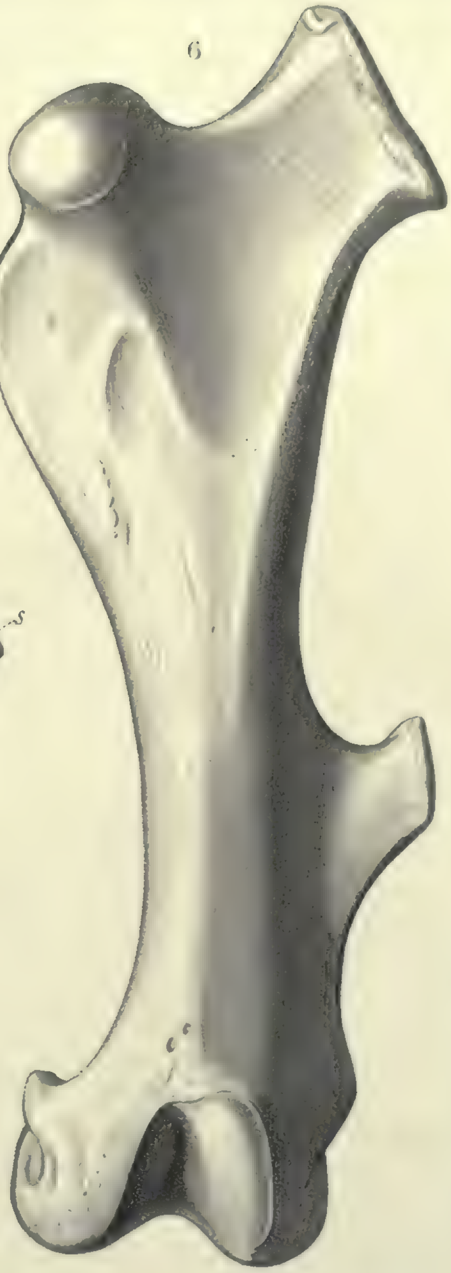

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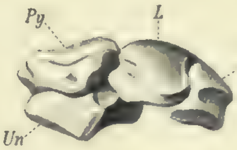

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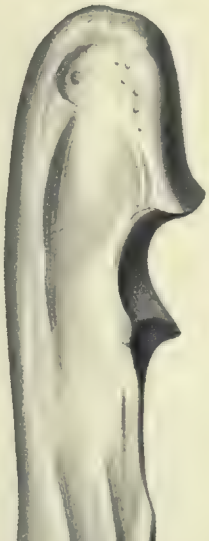

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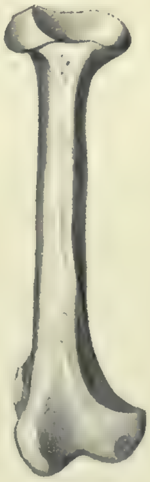

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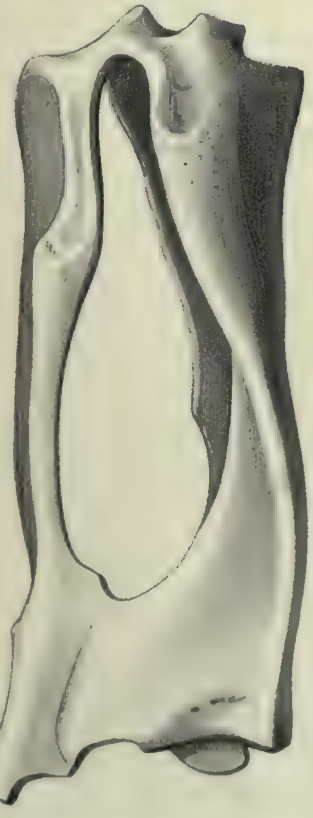

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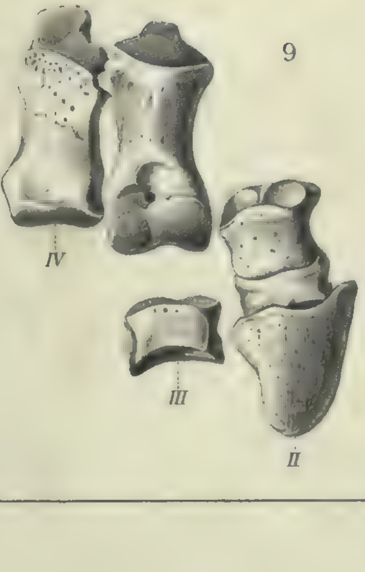

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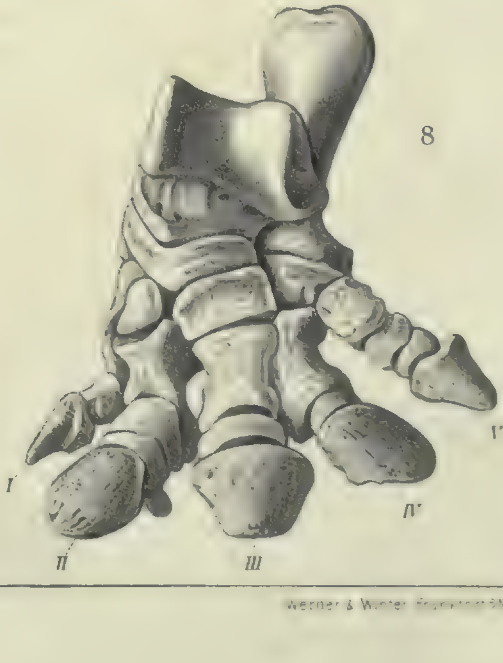

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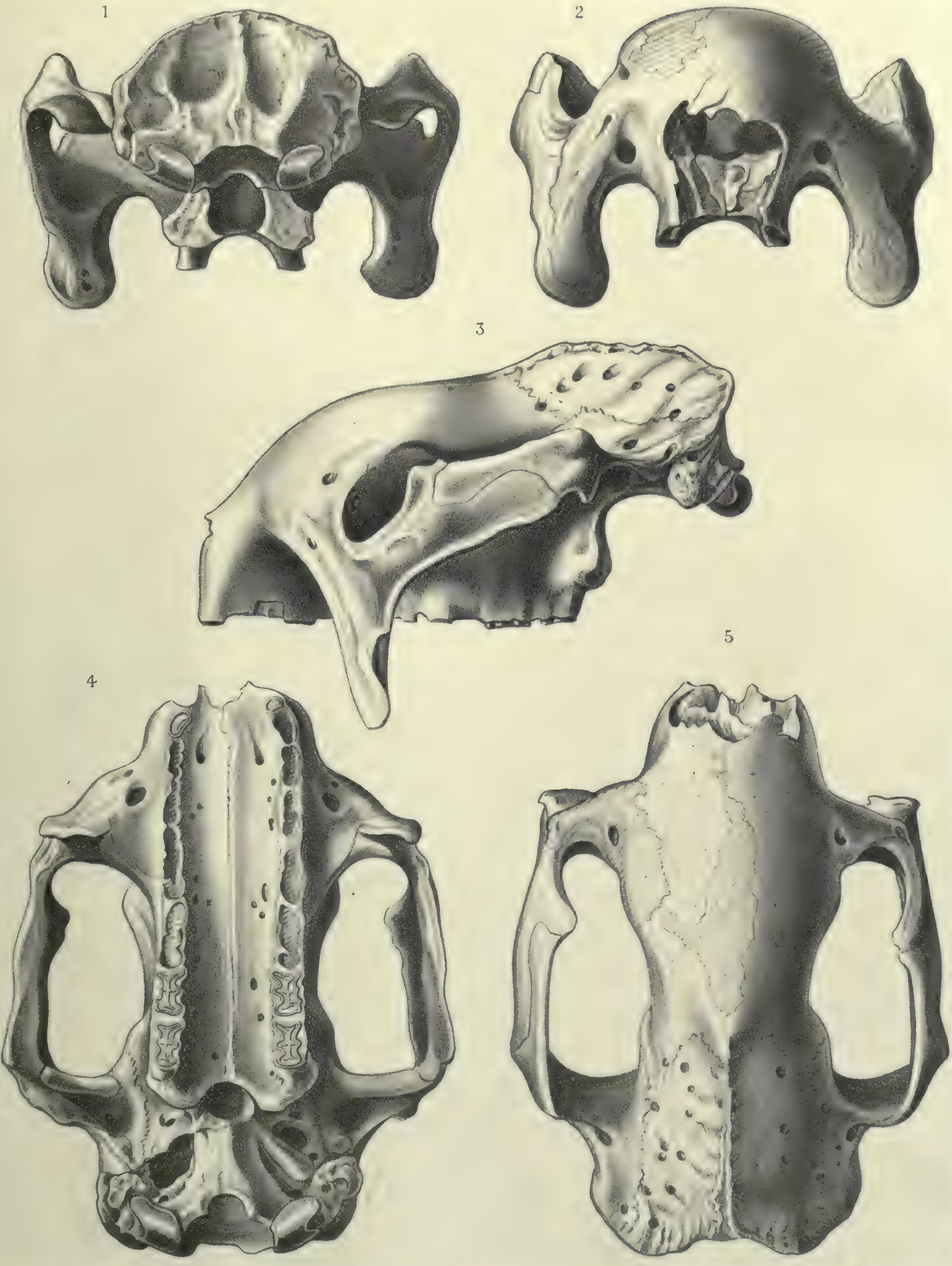
Werner & Winter, Frankfurt a/M. lith.

PROPALÆOHOPLOPHORUS

EXPLANATION OF PLATE XXVII.

PAGE
Fig. 1. PROPALÆOHOPLOPHORUS MINOR: Skull, from the rear 138
Fig. 2. " " " from the front.
Fig. 3. " " " left side.
Fig. 4. " " " ventral view.
Fig. 5. " " " dorsal view.

All the figures are ¾ natural size and are drawn from one individual (American Museum of Natural History, No. 9,197). This plate was erroneously labelled *Cochlops* and the mistake was not discovered until after the edition had been printed.



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Werner & Winter, Frankfort a/M., lith.

PROPALÆOHOPLOPHORUS

EXPLANATION OF PLATE XXVIII.

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Fig. 3. Cochlops debilis: Skull, right side (No. 15,592) 146
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Fig. 5. Metopotoxus anceps, type: Skull, right side (No. 15,612) 158
Fig. 6. " " " " dorsal view " "

All figures ¾ natural size.

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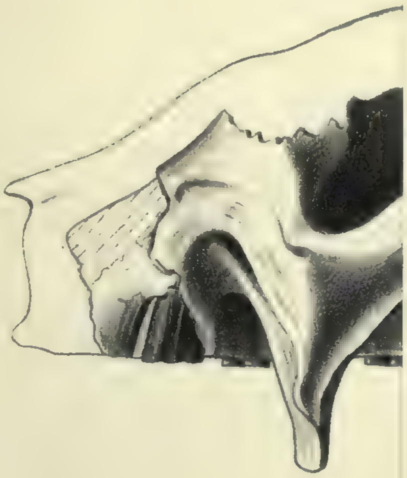

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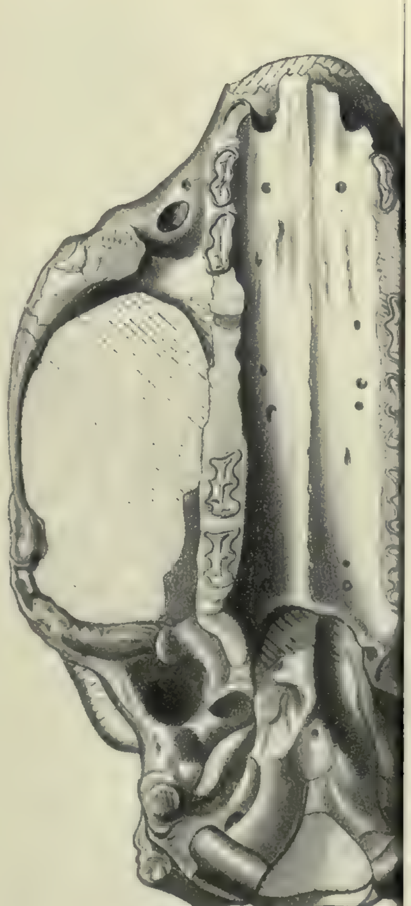

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EXPLANATION OF PLATE XXIX.

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Fig. 2. Eucinepeltus complicatus, type: Skull, front view (Amer. Mus. Nat. Hist., No. 9,248).

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Fig. 4. Eucinepeltus complicatus, type: Skull, rear view (Amer. Mus. Nat. Hist., No. 9,248).

Fig. 5. Eucinepeltus complicatus, type: Skull, left side (Amer. Mus. Nat. Hist., No. 9,248).

Fig. 6. Metopotoxus anceps, type: Skull and atlas, ventral side (No. 15,612). 158

All figures ¾ natural size.

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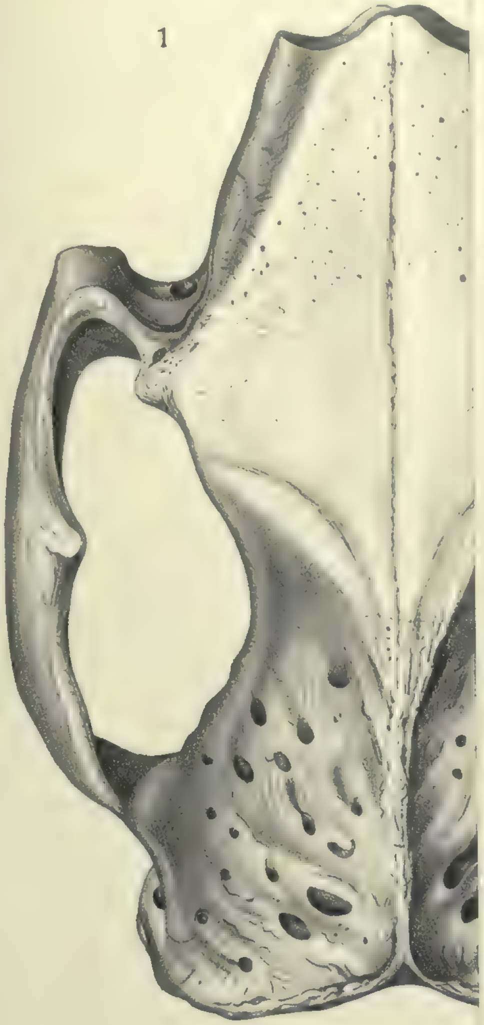

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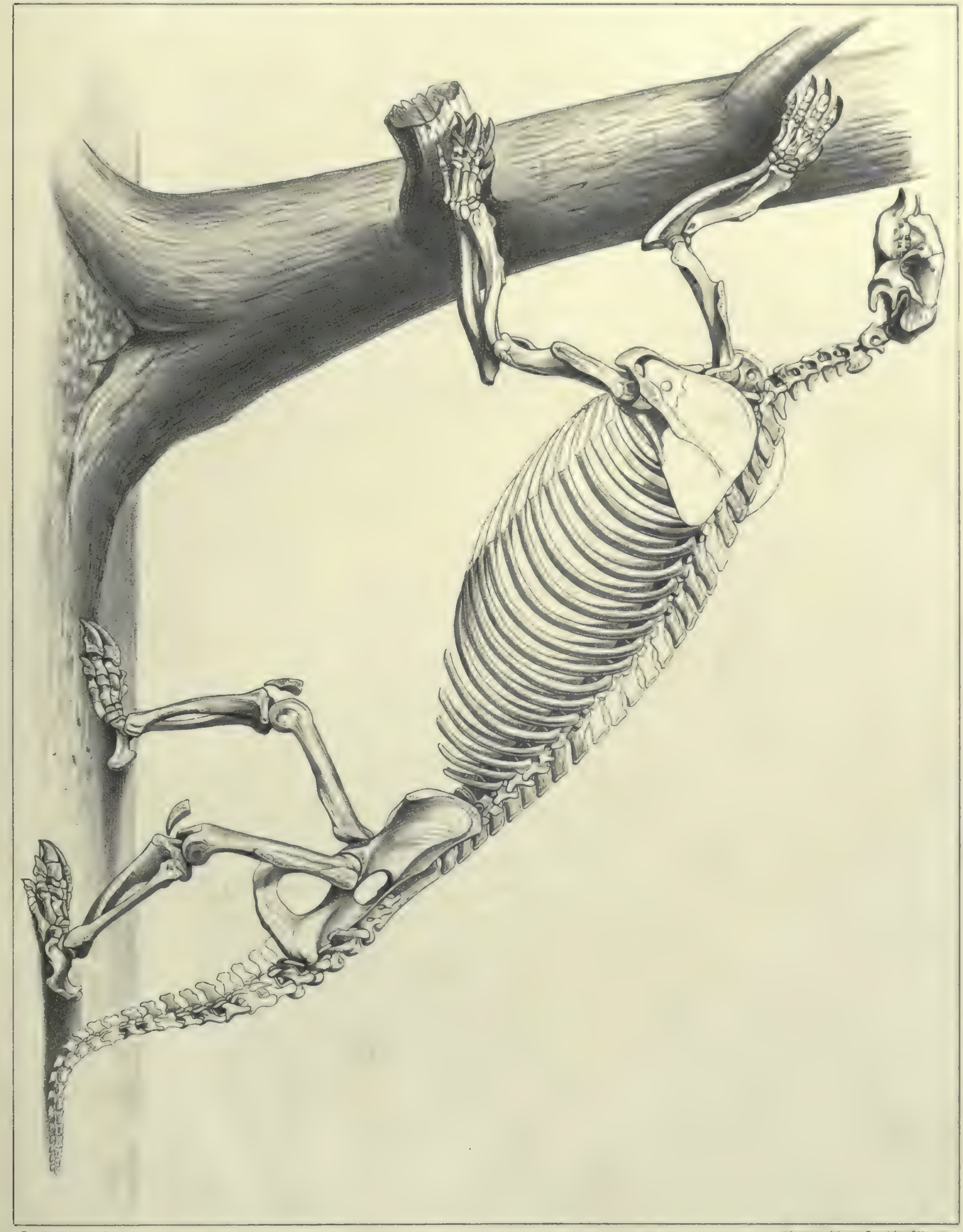
EXPLANATION OF PLATE XXX.

	PAGE
HAPALOPS LONGICEPS: Restoration of skeleton, slightly less than ⅙ natural size	205

The drawing has been made almost entirely from the type-specimen, with the missing parts supplied from other species of the same genus. It is probable that the tail is somewhat too long in the figure.



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Werner & Winter Frankfort a/M., lith.

HAPALOPS.

EXPLANATION OF PLATE XXXI.

PAGE

Fig. 1. Hapalops longiceps, type: Skull, left side (No. 15,523) . . . 182

Fig. 2. " " " " base " "

Fig. 3. " " " " top " "

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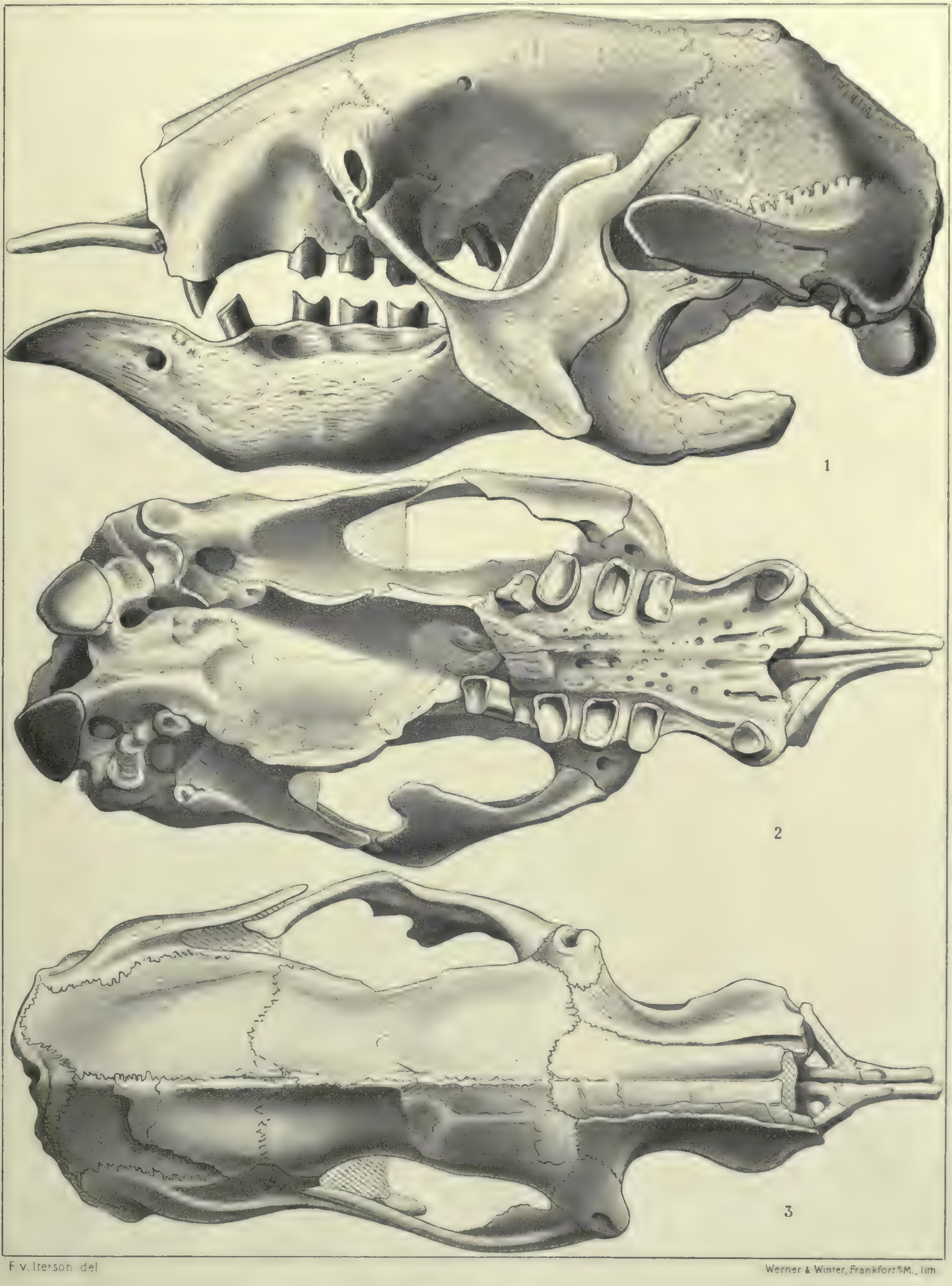

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HAPALOPS.

EXPLANATION OF PLATE XXXII.

							PAGE
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Fig. 2.	"	"	"	Right humerus, front, × ¾	"	"	191
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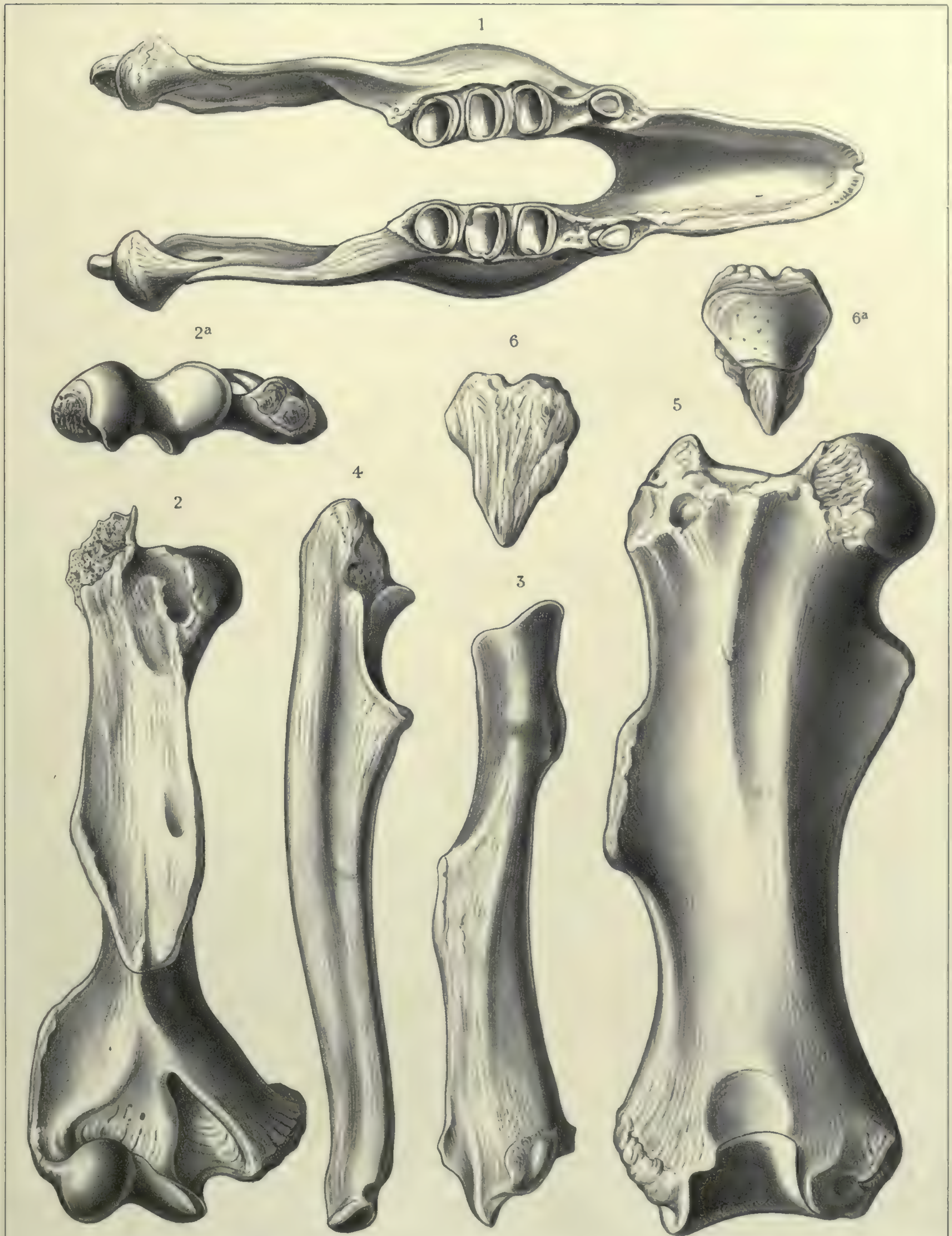
Fig. 6*a*.	"	"	"	" rear, × ¾	"	"	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Werner & Winter, Frankfort a/M., lith.

HAPALOPS.

EXPLANATION OF PLATE XXXIII.

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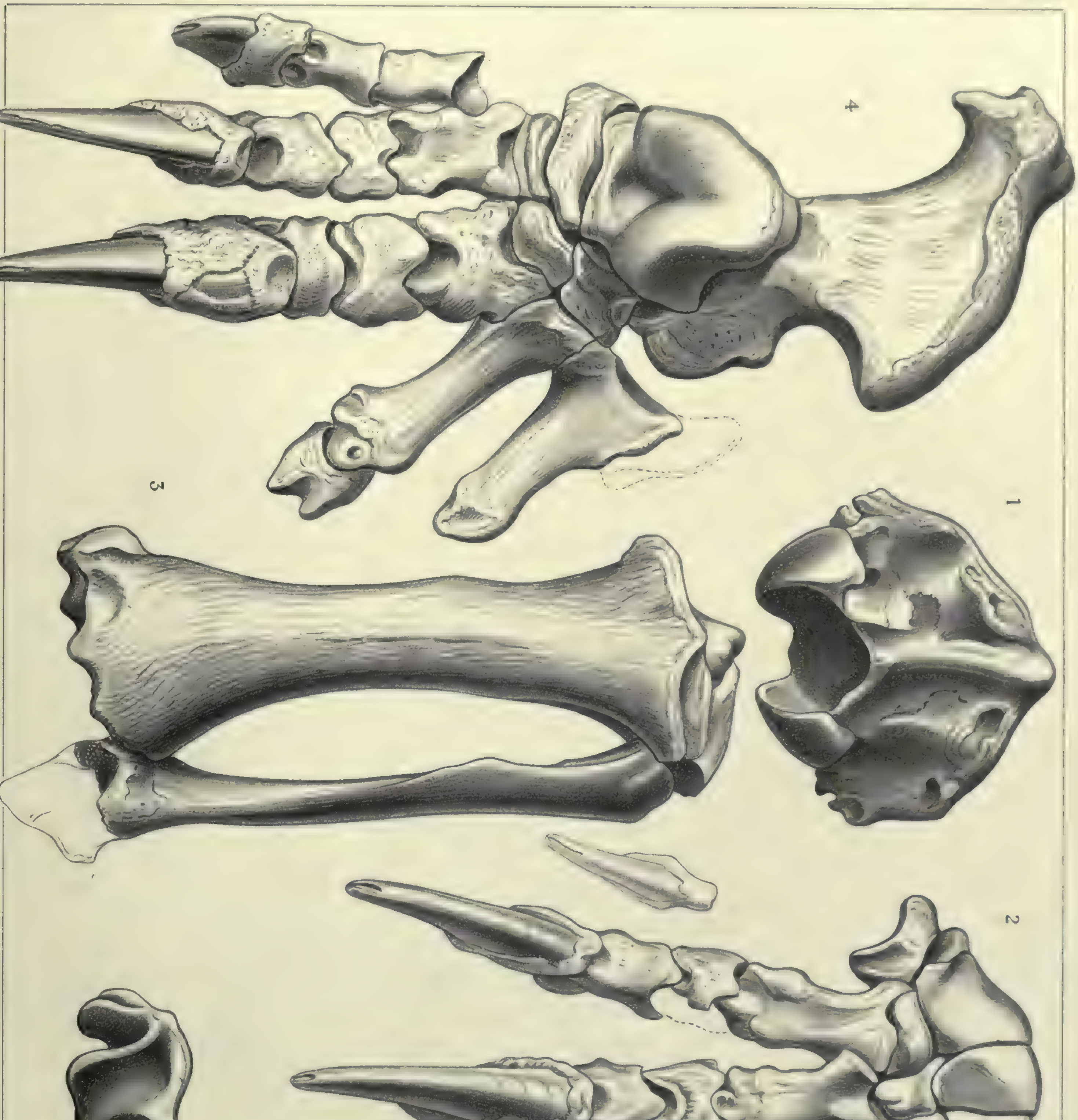
Fig. 4.	" " "	Left pes, dorsum; nat. size. " "	200

PLATE XXXIII.



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HAPALOPS.

EXPLANATION OF PLATE XXXIV.

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Fig. 3. " " " base " "
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Fig. 5. " " " ventral side "
Fig. 6. Hapalops sp.: Left manus, dorsum (No. 15,171) 181

All figures natural size.

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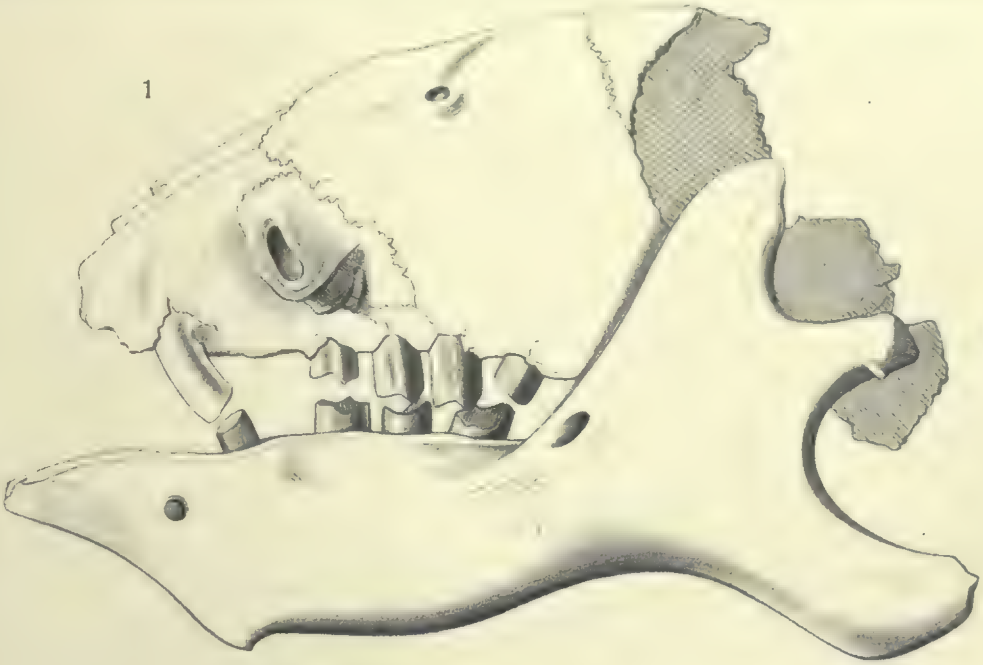

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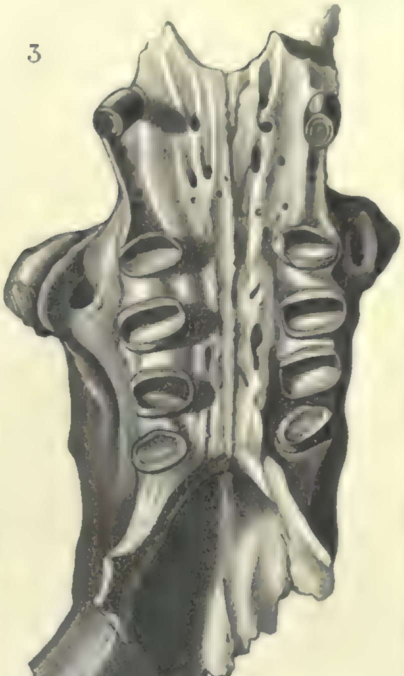

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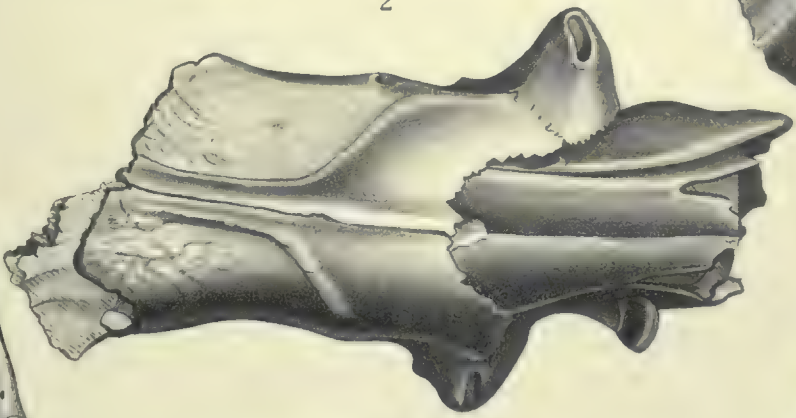

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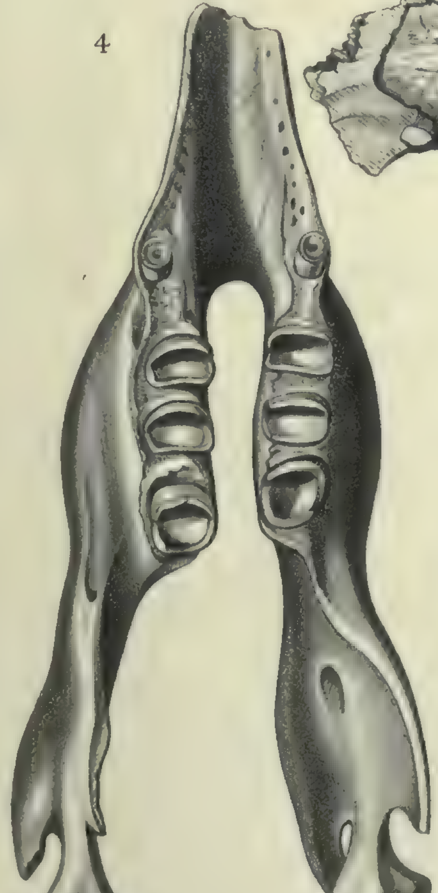

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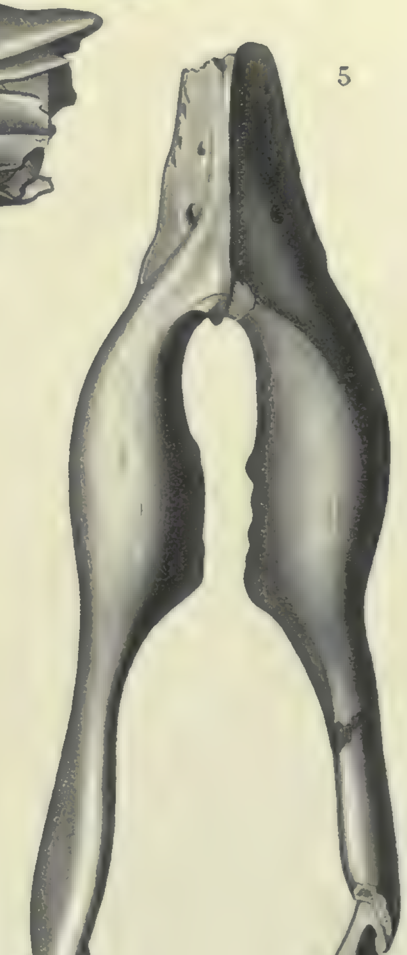

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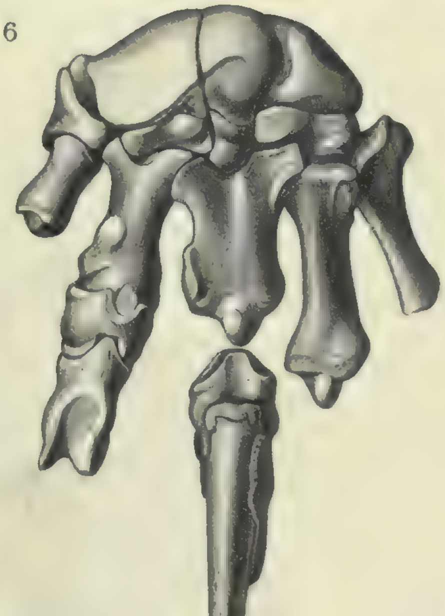

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Werner & Winter, Frankfurt a/M. lith.

HAPALOPS

EXPLANATION OF PLATE XXXV.

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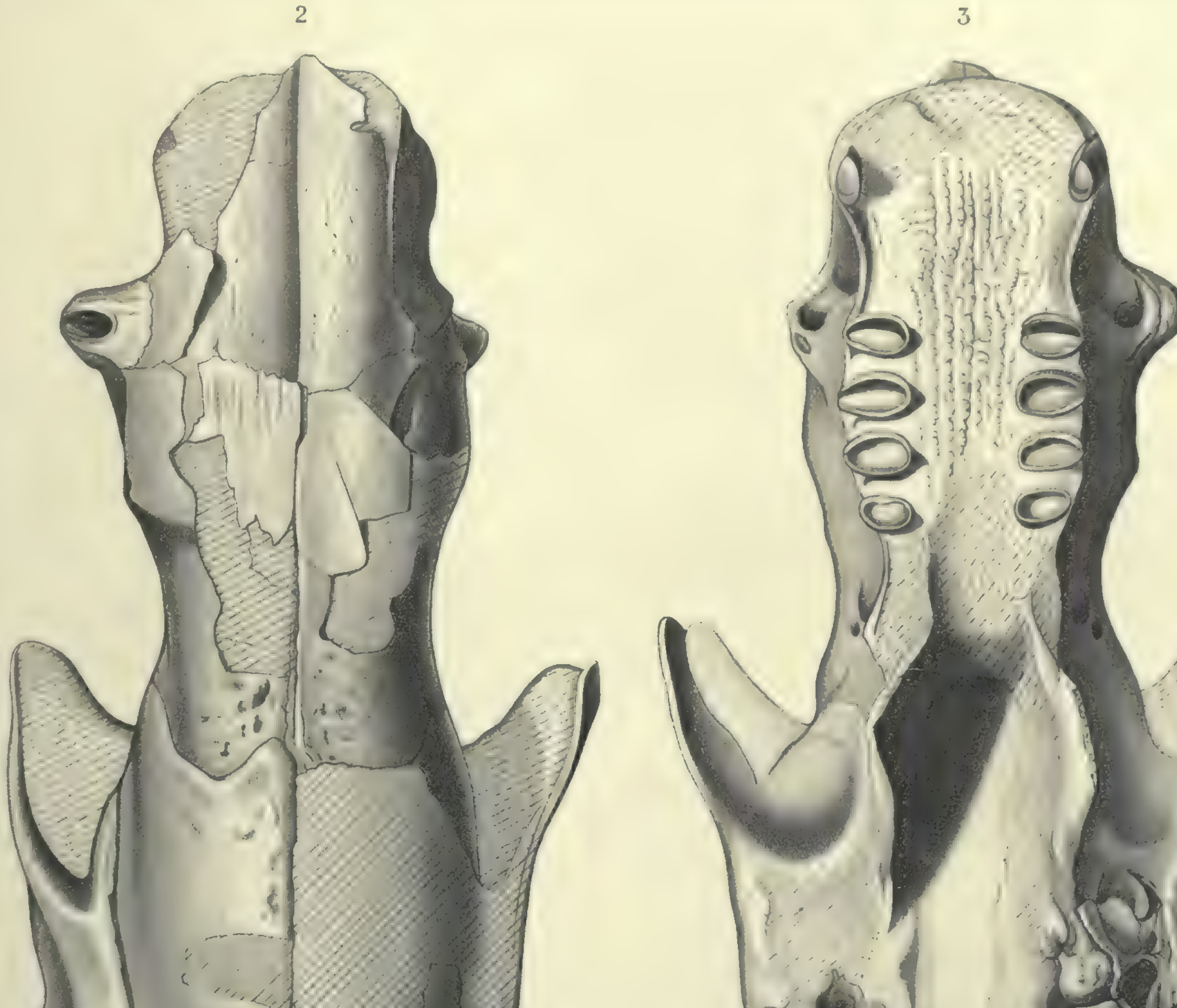
Fig. 3.	" " " base " "	

All figures natural size.

PLATE XXXV.



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Werner & Winter, Frankfort a/M., lith

HAPALOPS.

EXPLANATION OF PLATE XXXVI.

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Fig. 3.	" " Skull, top view.	
Fig. 4.	" " Skull, base.	

All figures natural size.

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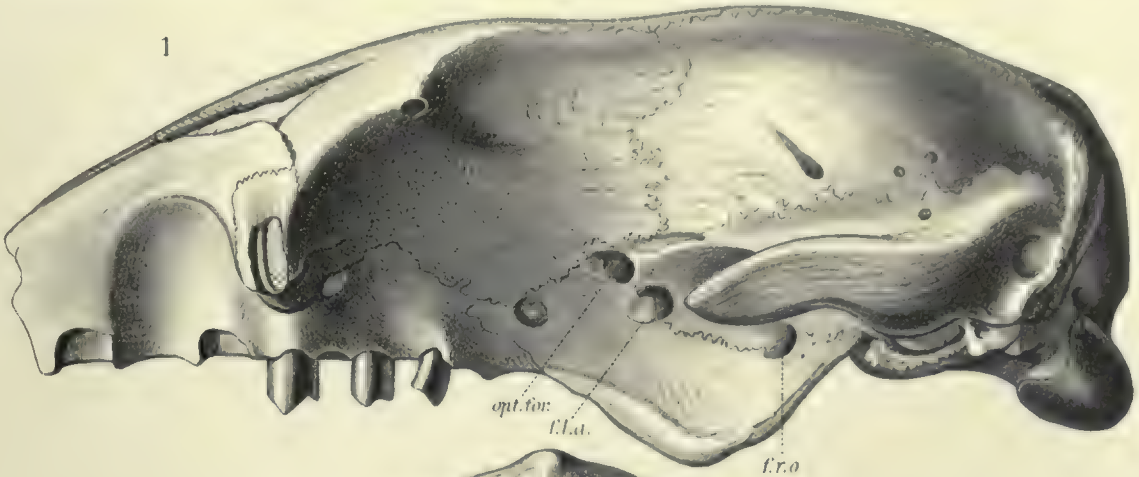
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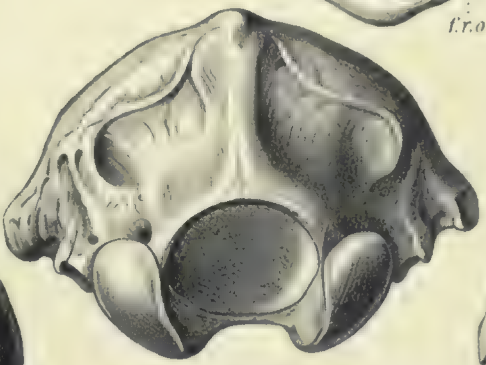

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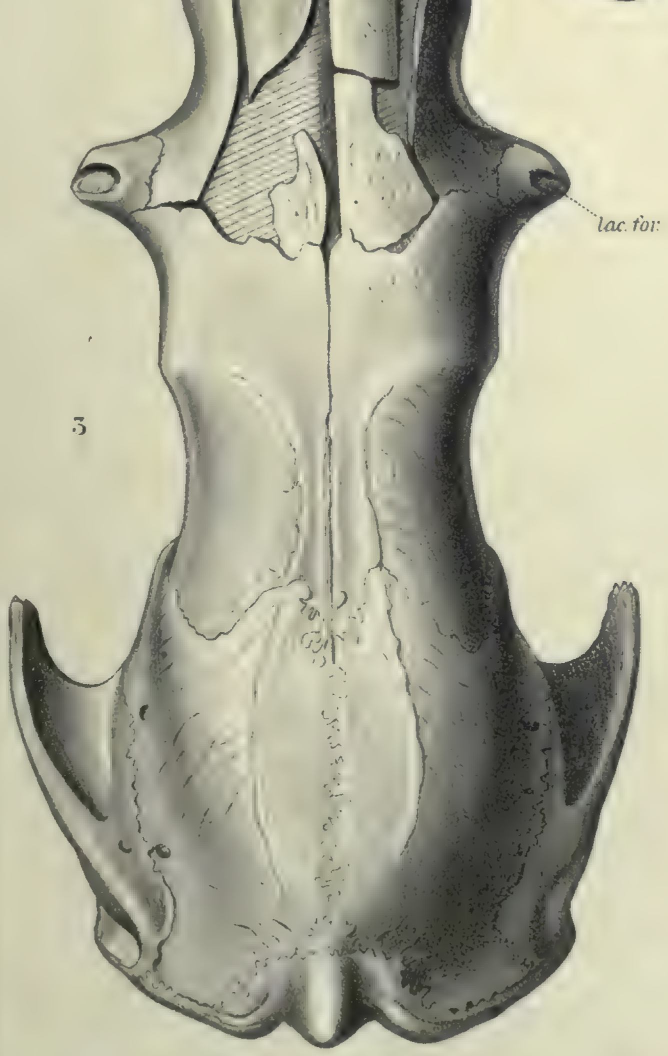

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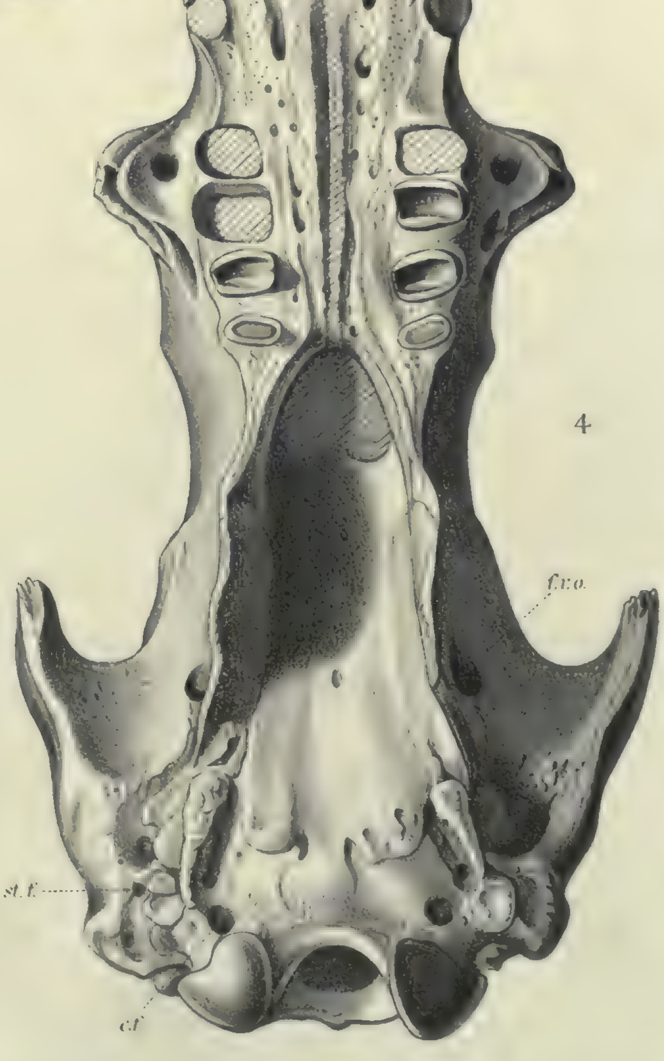

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HAPALOPS.

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Fig. 3.	" " " right side (No. 15,160)	219
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All figures natural size.

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All figures natural size.

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EXPLANATION OF PLATE XXXIX.

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EXPLANATION OF PLATE XL.

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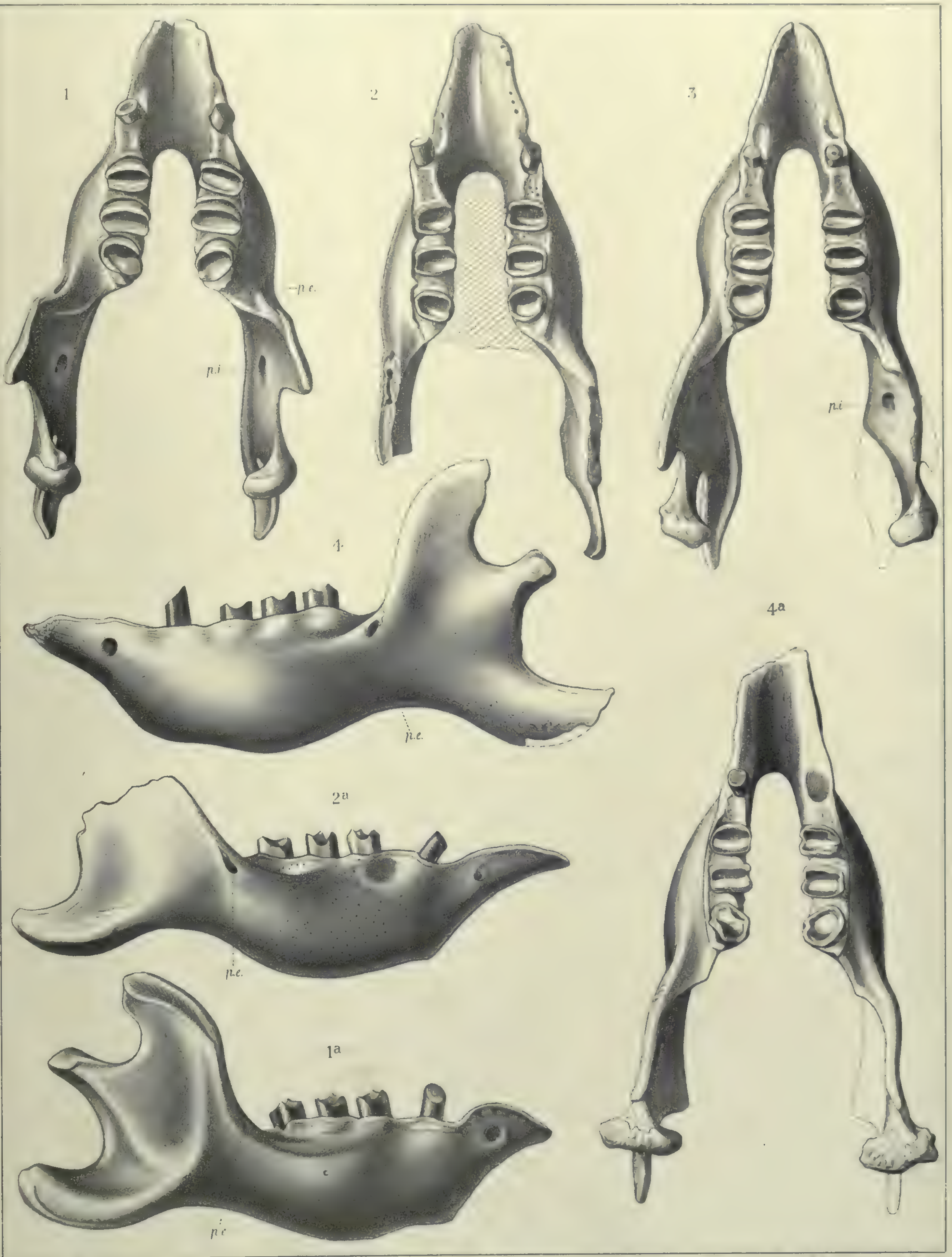
All figures natural size.

PLATE XL.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Werner & Winter, Frankfort a/M., lith.

HAPALOPS.

EXPLANATION OF PLATE XLI.

			PAGE
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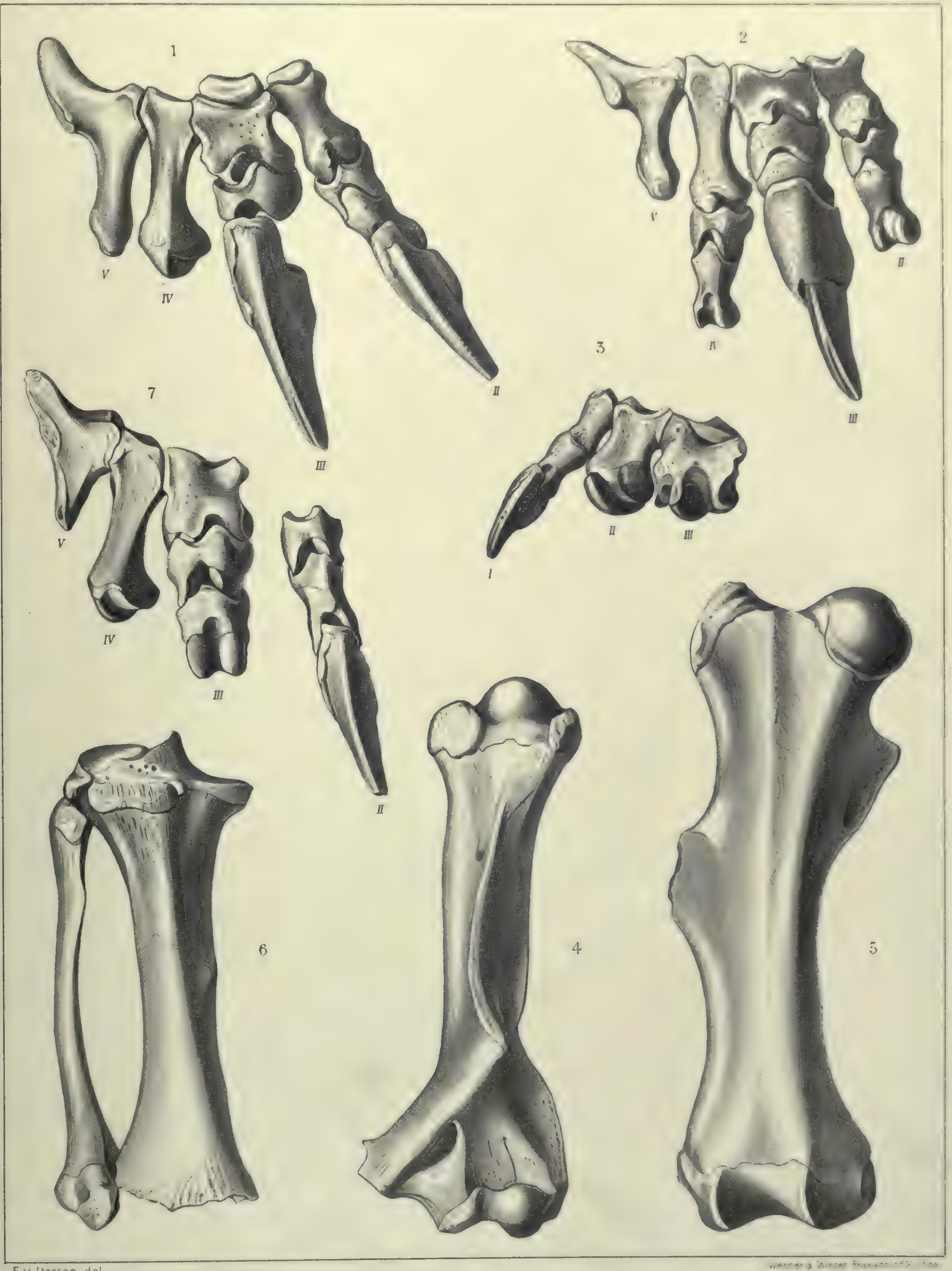
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Werner & Winter Frankfurt a/M. lith.

HAPALOPS.

EXPLANATION OF PLATE XLII.

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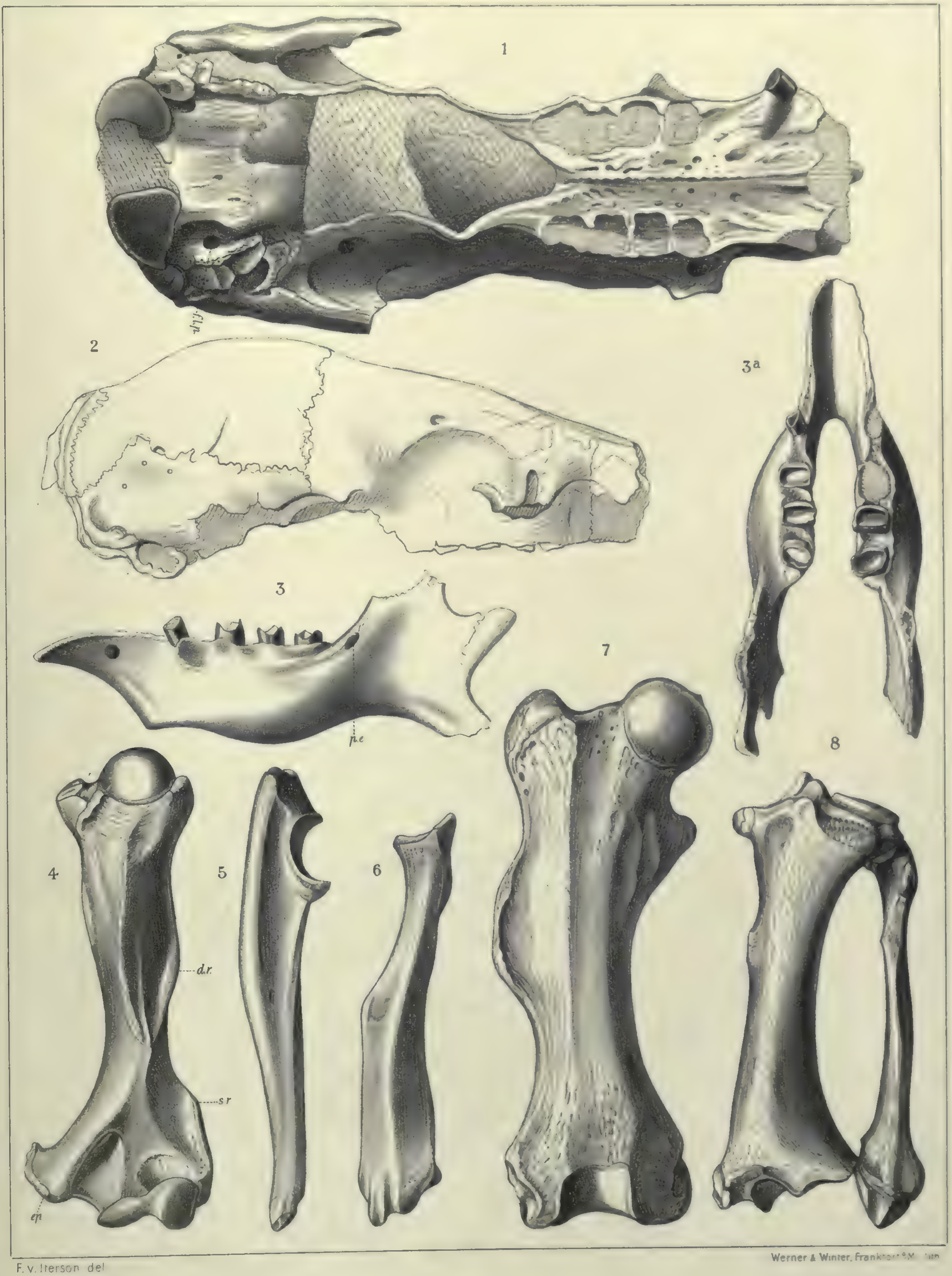
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Werner & Winter, Frankfort a/M. lith.

HAPALOPS.

EXPLANATION OF PLATE XLIV.

		PAGE
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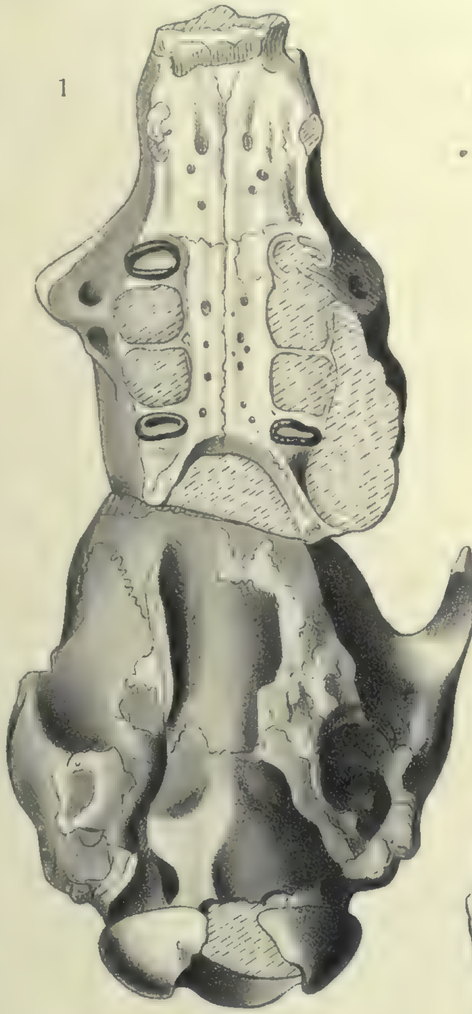

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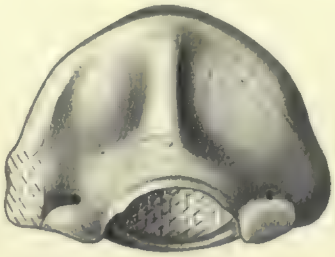

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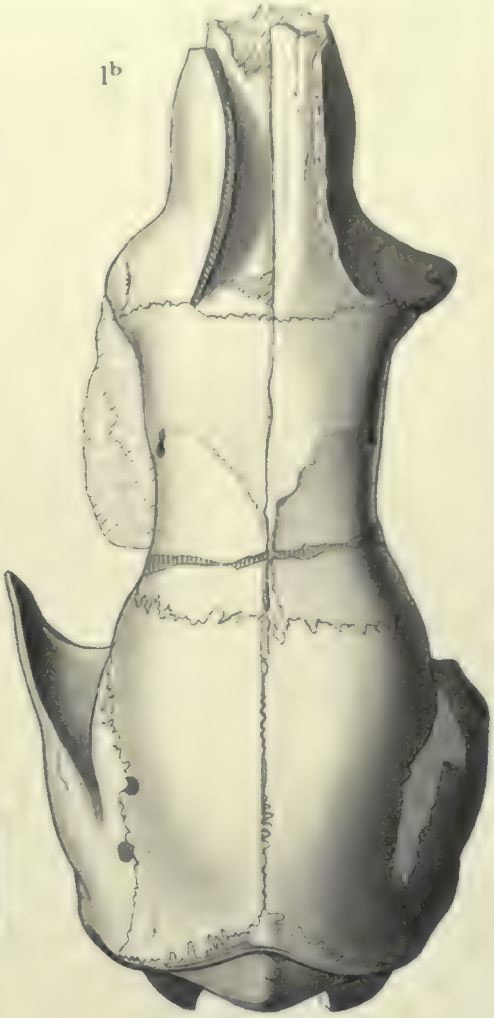

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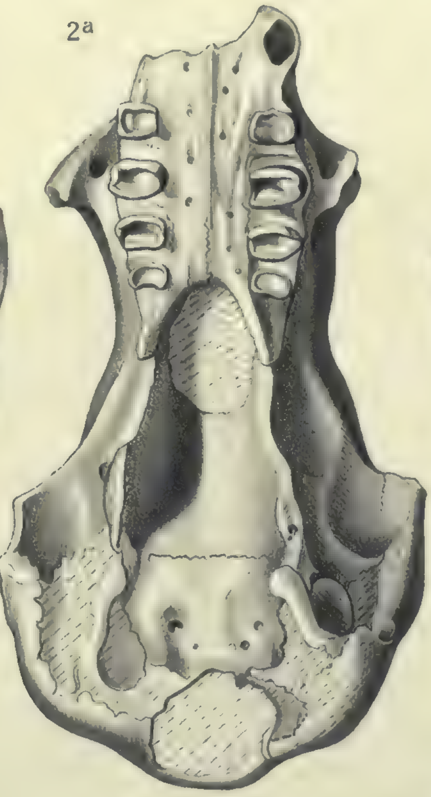

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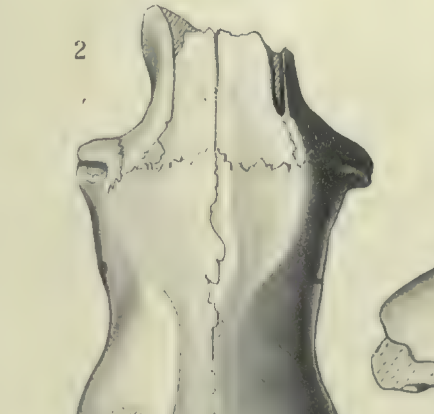

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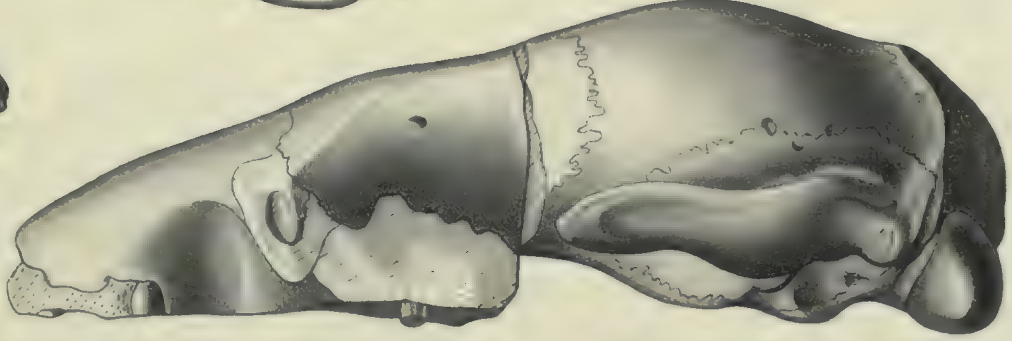

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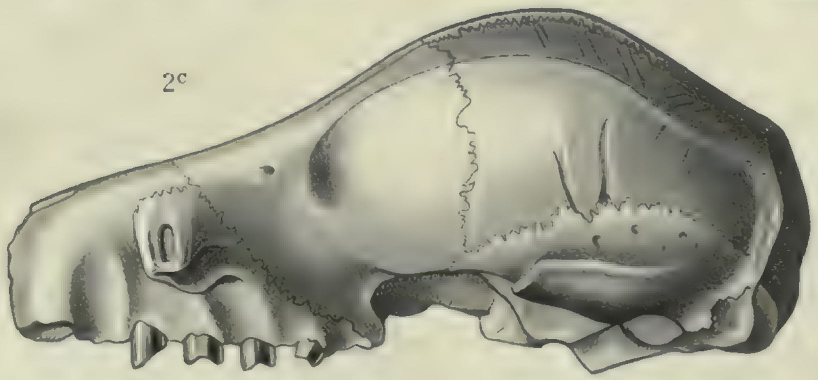

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HAPALOPS

EXPLANATION OF PLATE XLV.

		PAGE
Fig. 1.	Hapalops platycephalus? Skull, base (No. 15,522)	255
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Fig. 3*a*.	“ “ Occiput (No. 15,534).	
Fig. 4.	Hapalops gracilidens: Skull, top view (No. 15,525)	249

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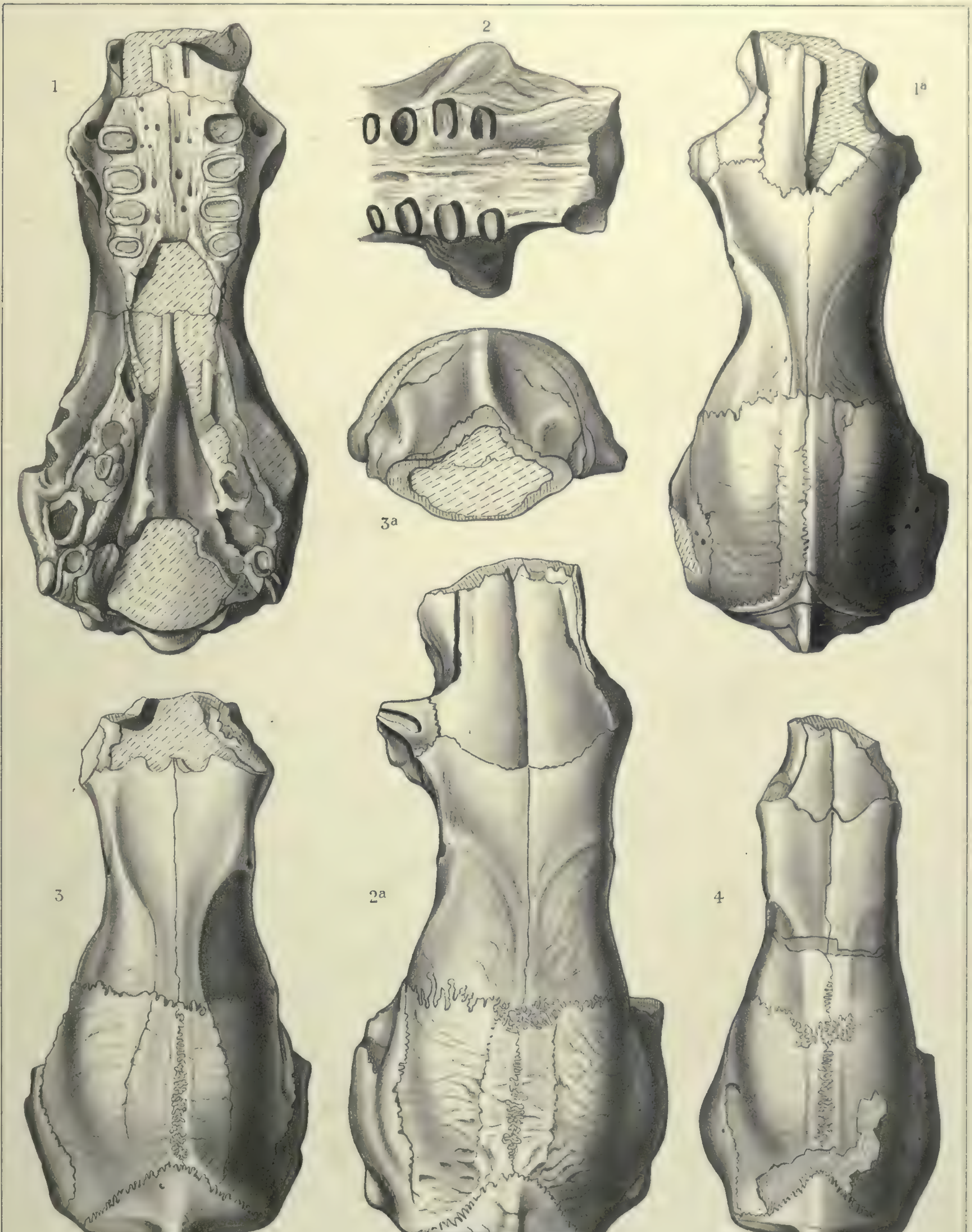
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Werner & Winter, Frankfurt a/M.

HAPALOPS

EXPLANATION OF PLATE XLVI.

					PAGE
Fig. 1.	MEGALONYCHOTHERIUM	ATAVUS,	type:	Skull, top view (No. 15,593).	278
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Fig. 3.	"	"	"	Skull, base.	
Fig. 4.	"	"	"	" right side.	

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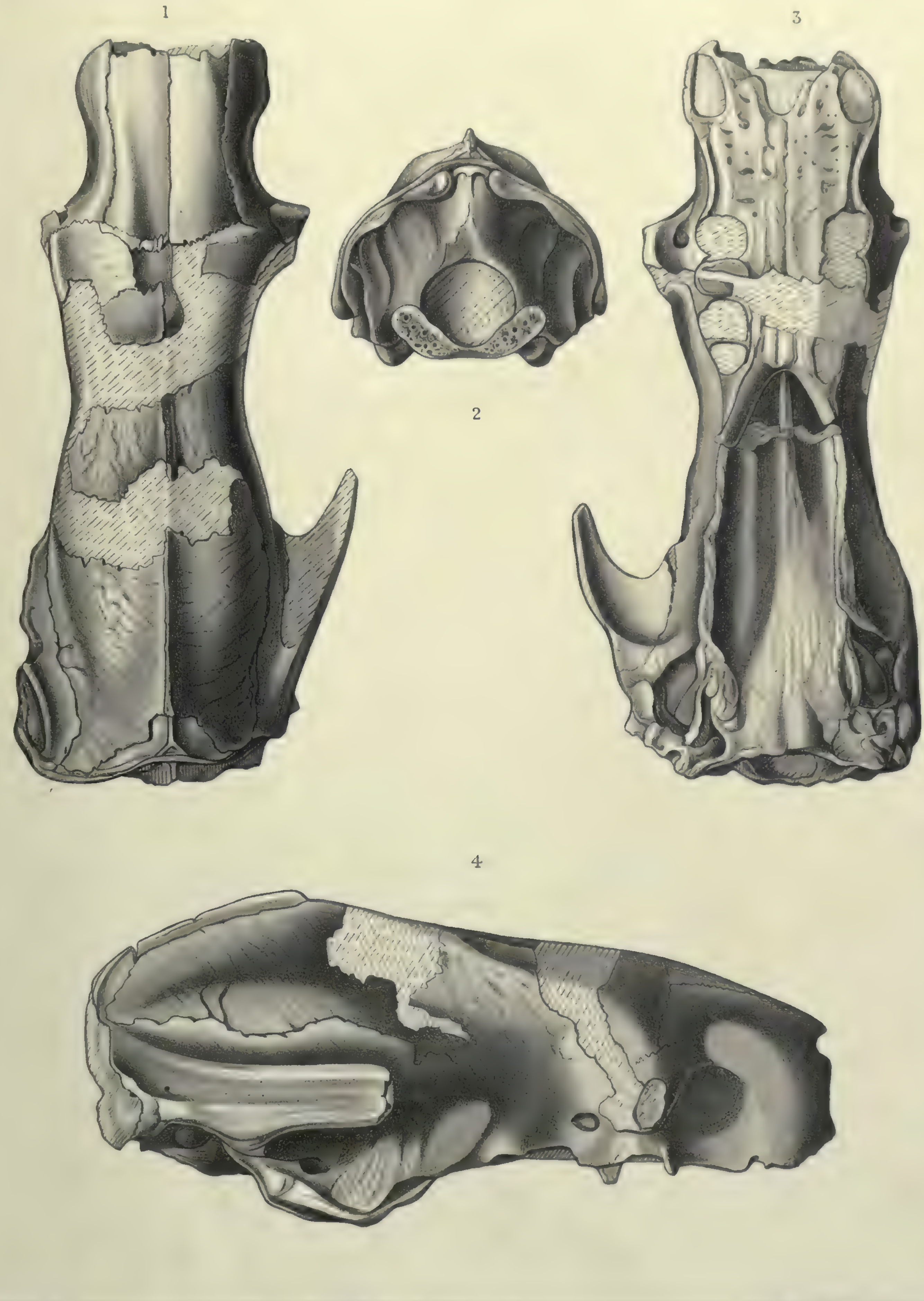

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Werner & Winter Frankfurt a/M. lith.

MEGALONYCHOTHERIUM

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		PAGE
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Fig. 2.	" " " top view.	
Fig. 3.	" " " base.	

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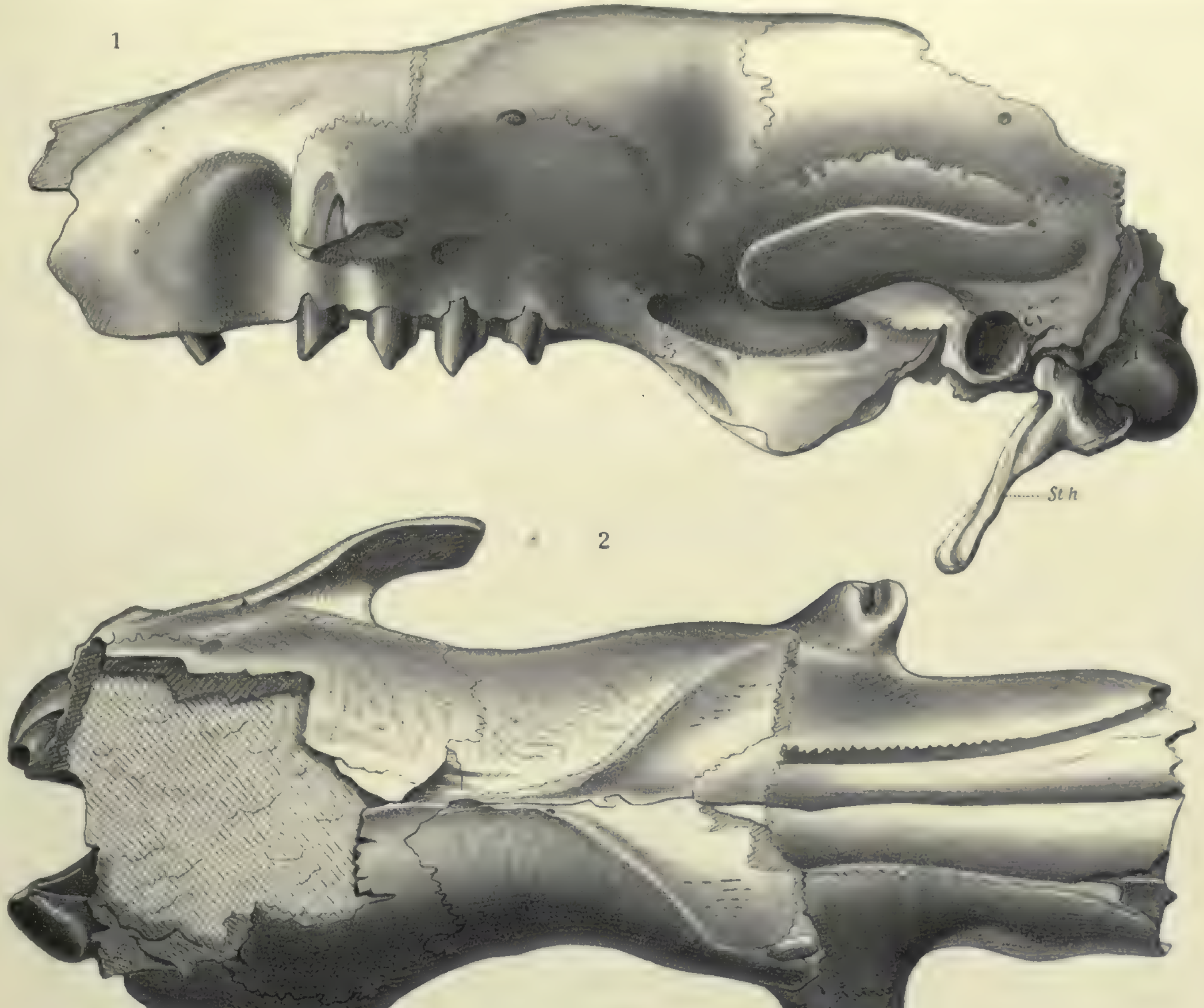
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ANALCIMORPHUS.

EXPLANATION OF PLATE XLVIII.

		PAGE
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Fig. 2.	" " " " top view.	
Fig. 3.	" " " " base.	

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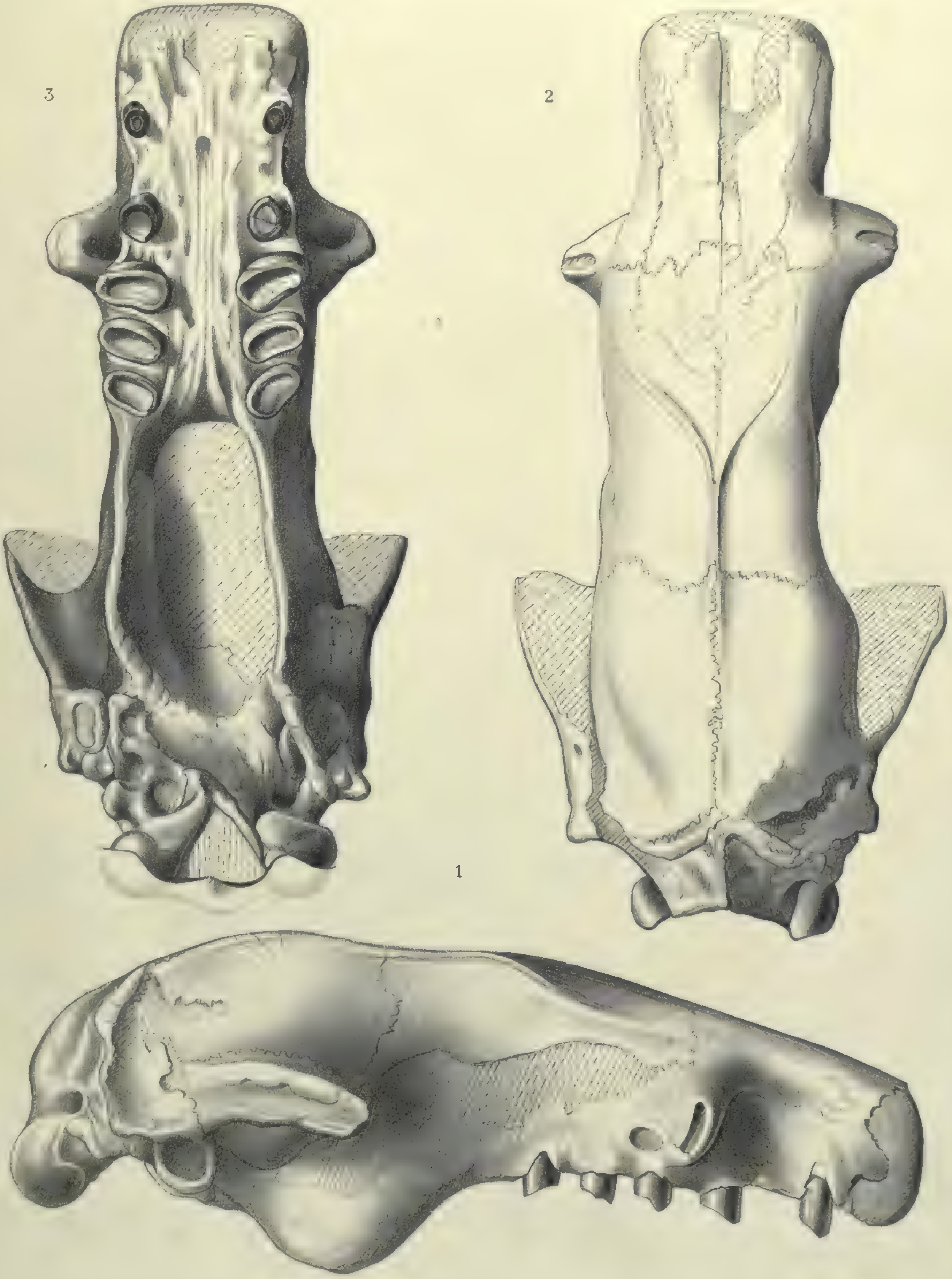

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ANALCIMORPHUS.

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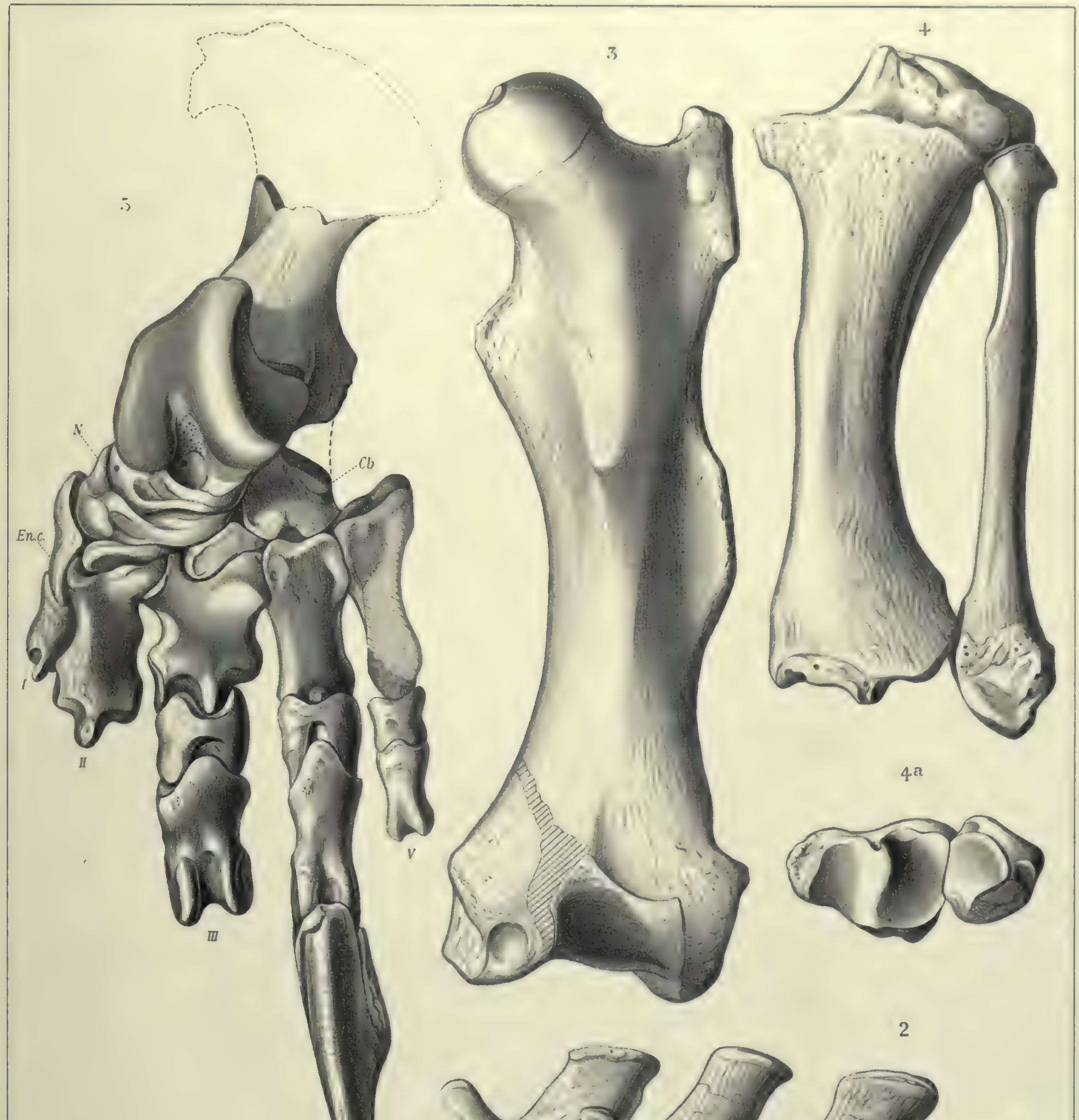
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Werner & Winter Frankfort a/M. lith.

ANALCIMORPHUS.

EXPLANATION OF PLATE L.

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Fig. 2*b*.	"	"	Occiput.	

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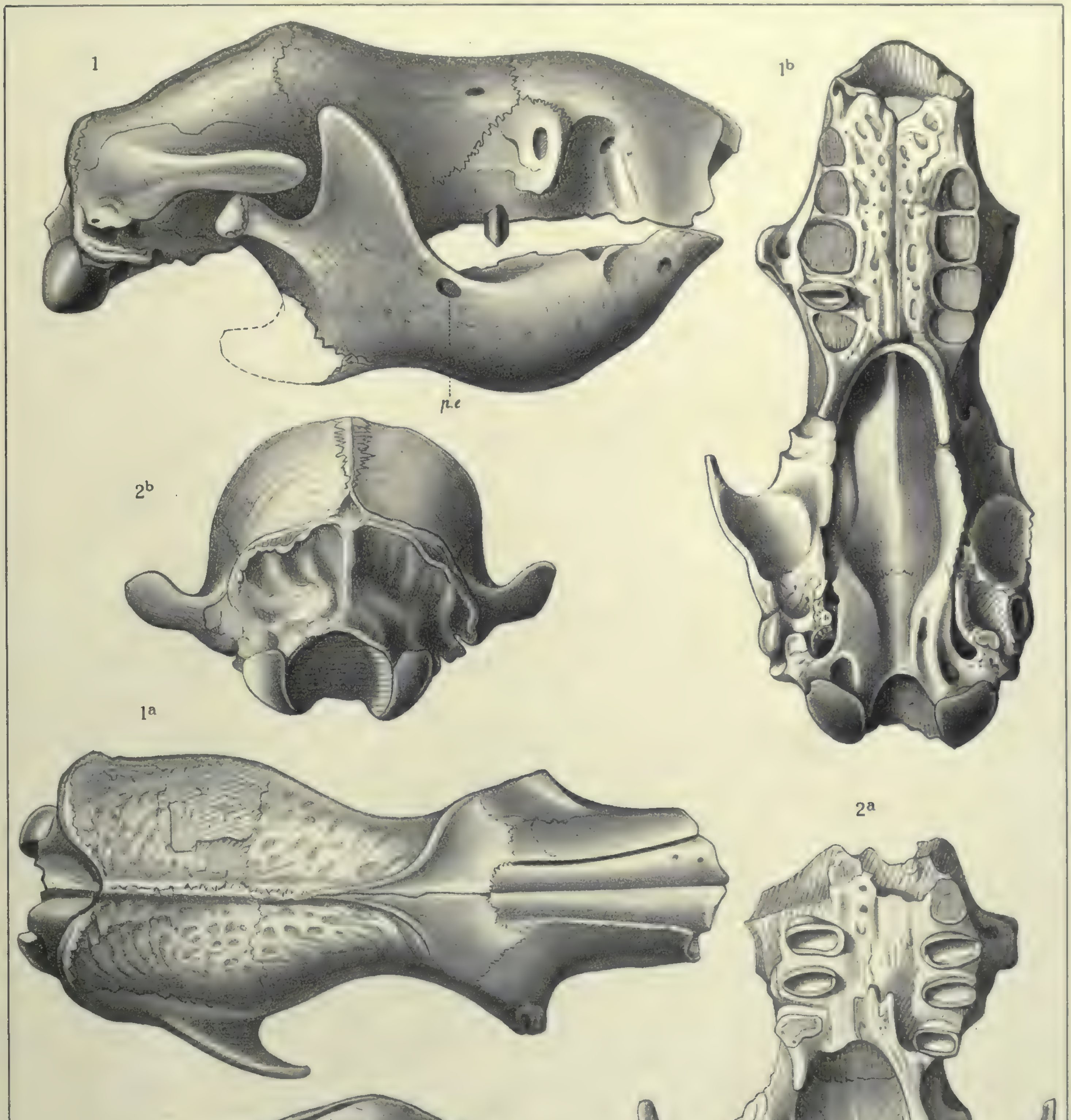
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SCHISMOTHERIUM.

EXPLANATION OF PLATE LI.

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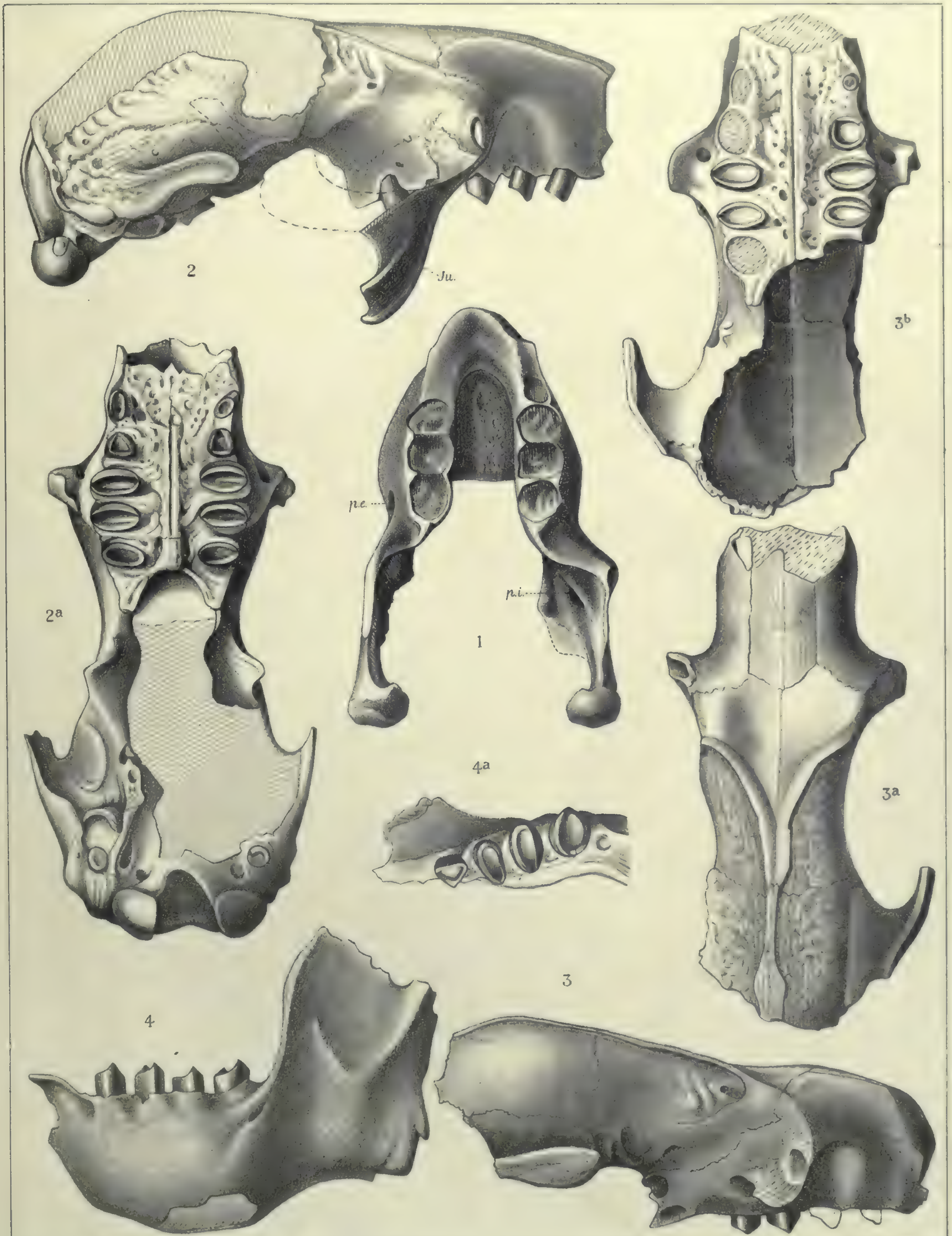
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SCHISMOTHERIUM.

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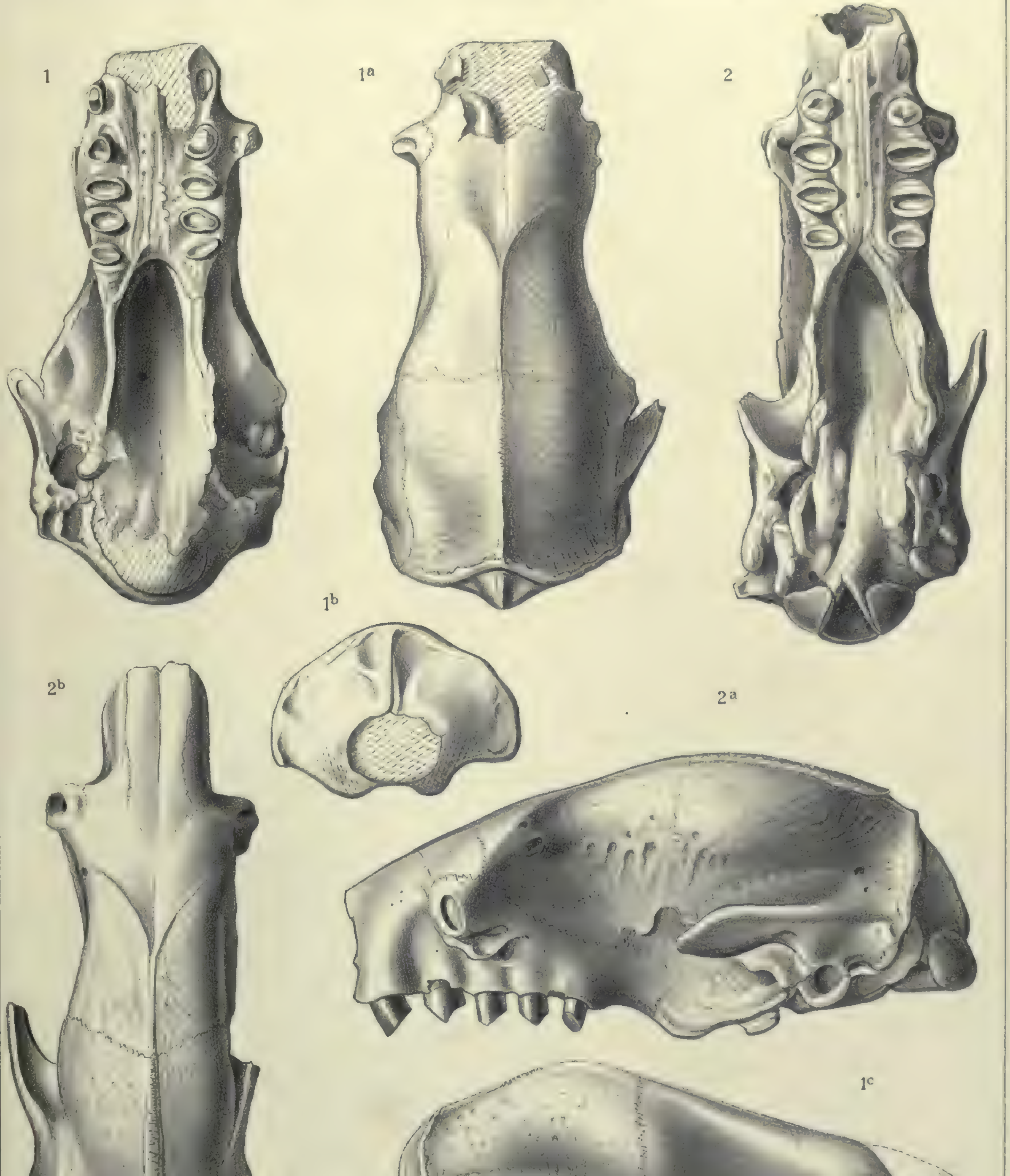
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PELECYODON.

EXPLANATION OF PLATE LIII.

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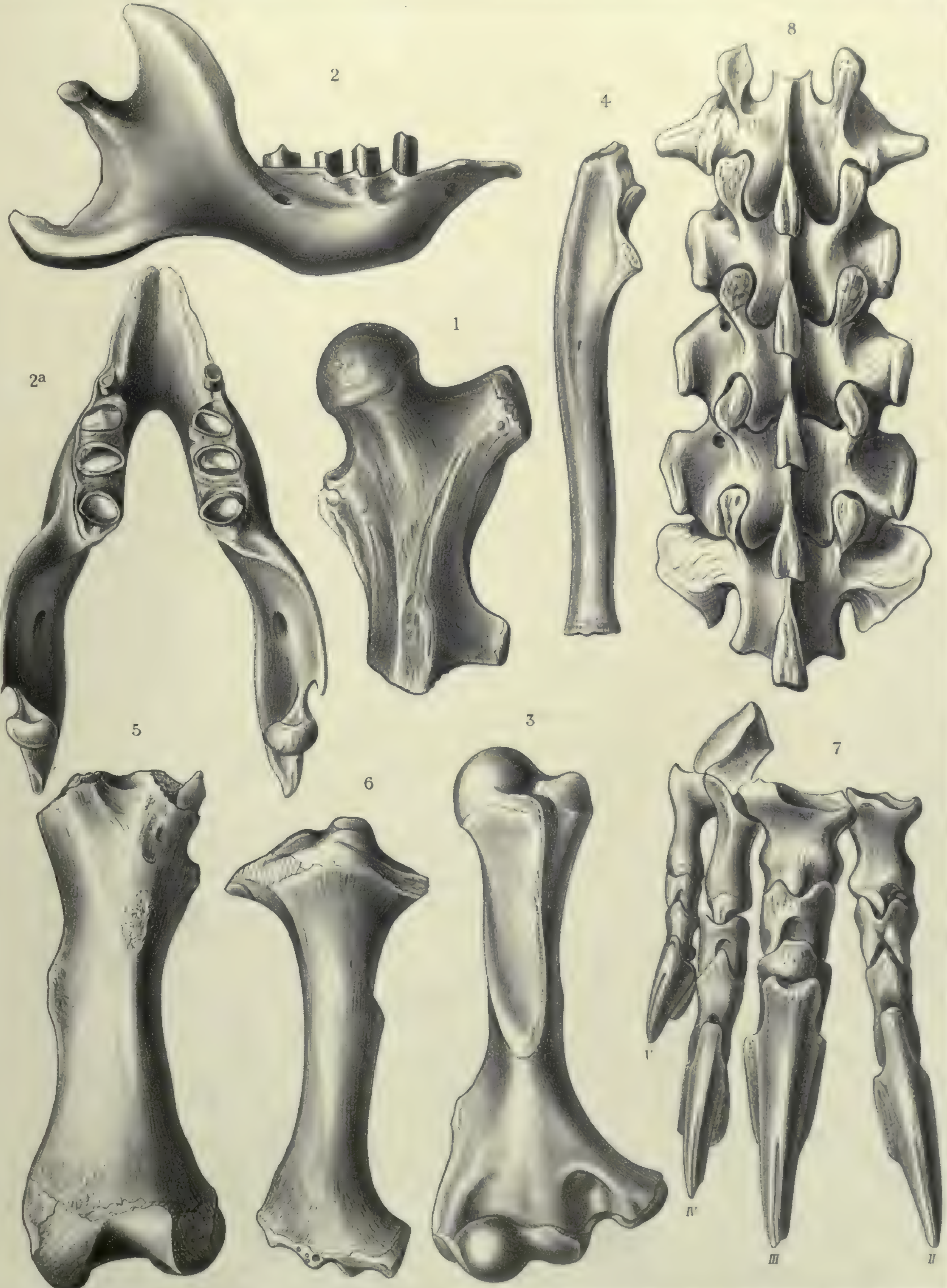
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SCHISMOTHERIUM & PELECYODON

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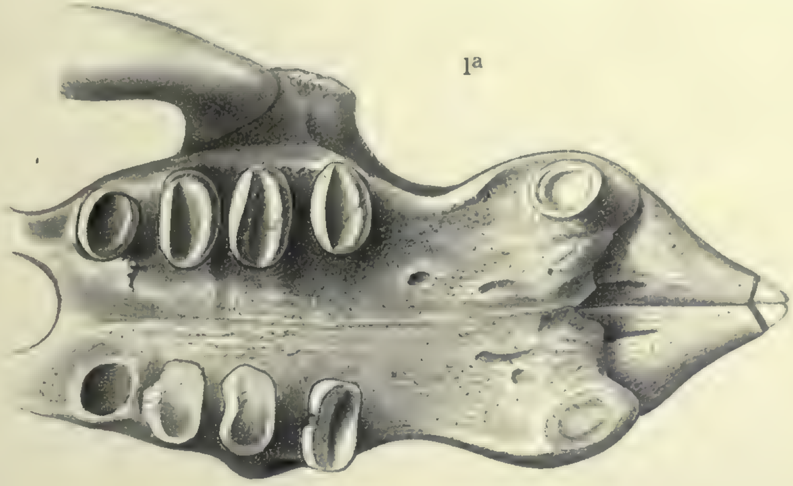

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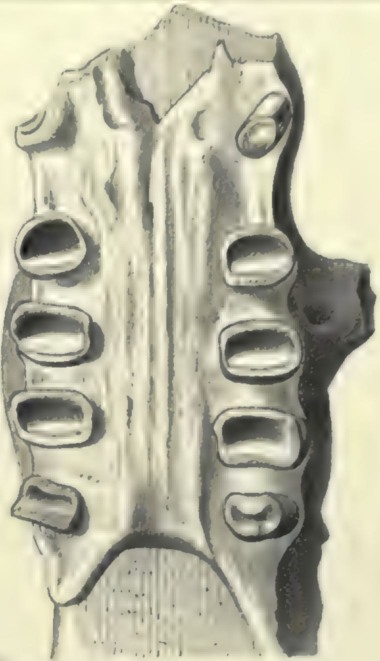

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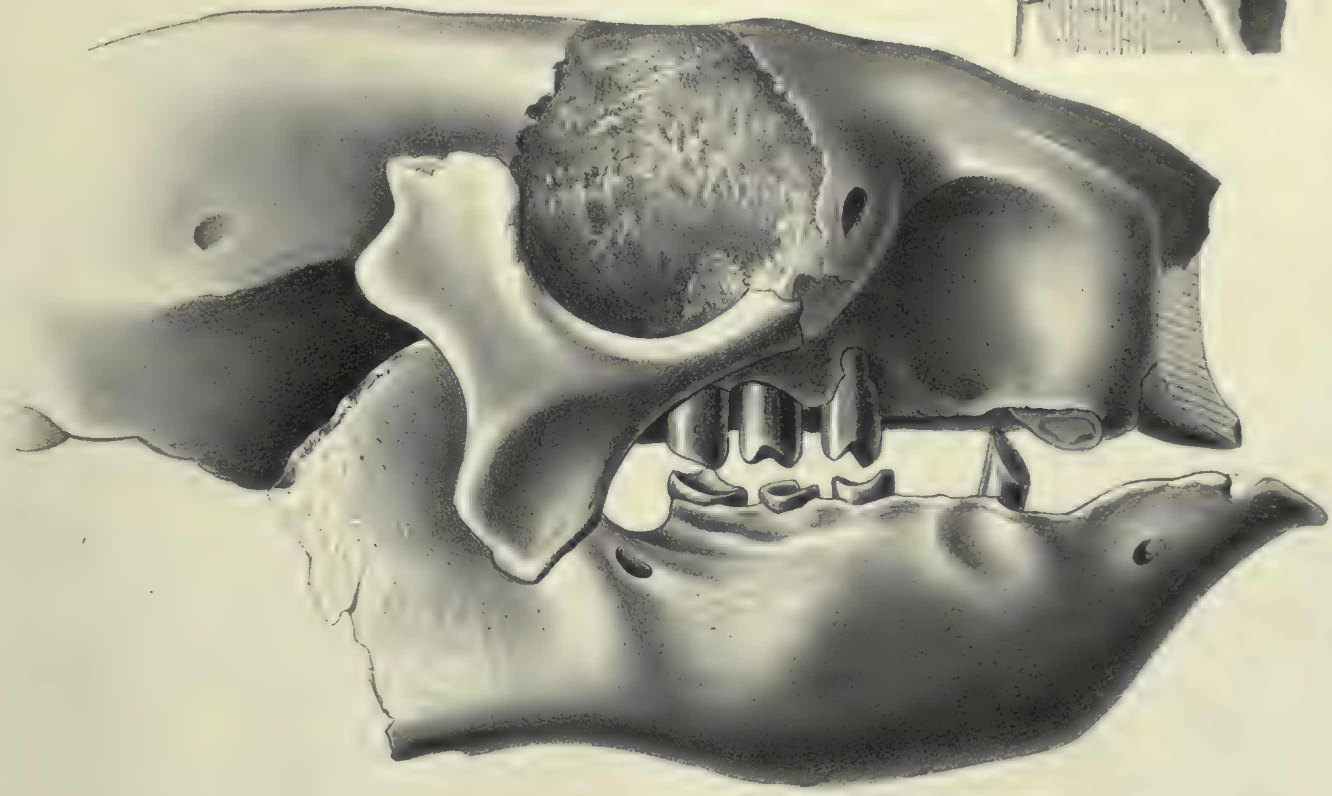

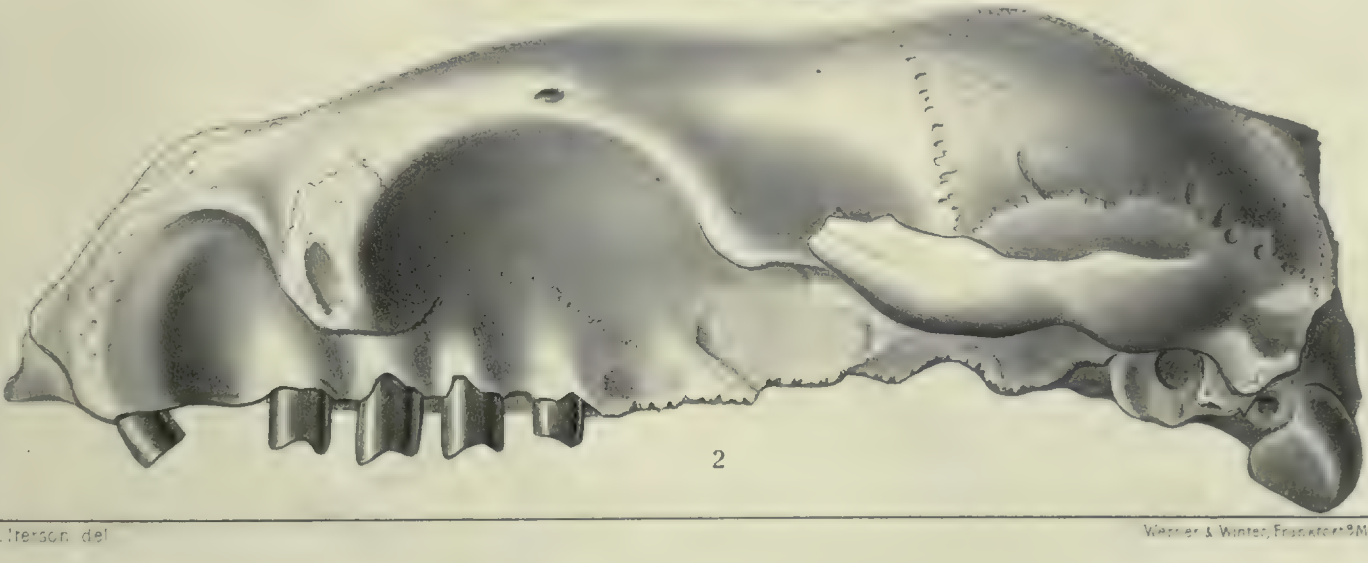

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HYPERLEPTUS

EXPLANATION OF PLATE LV.

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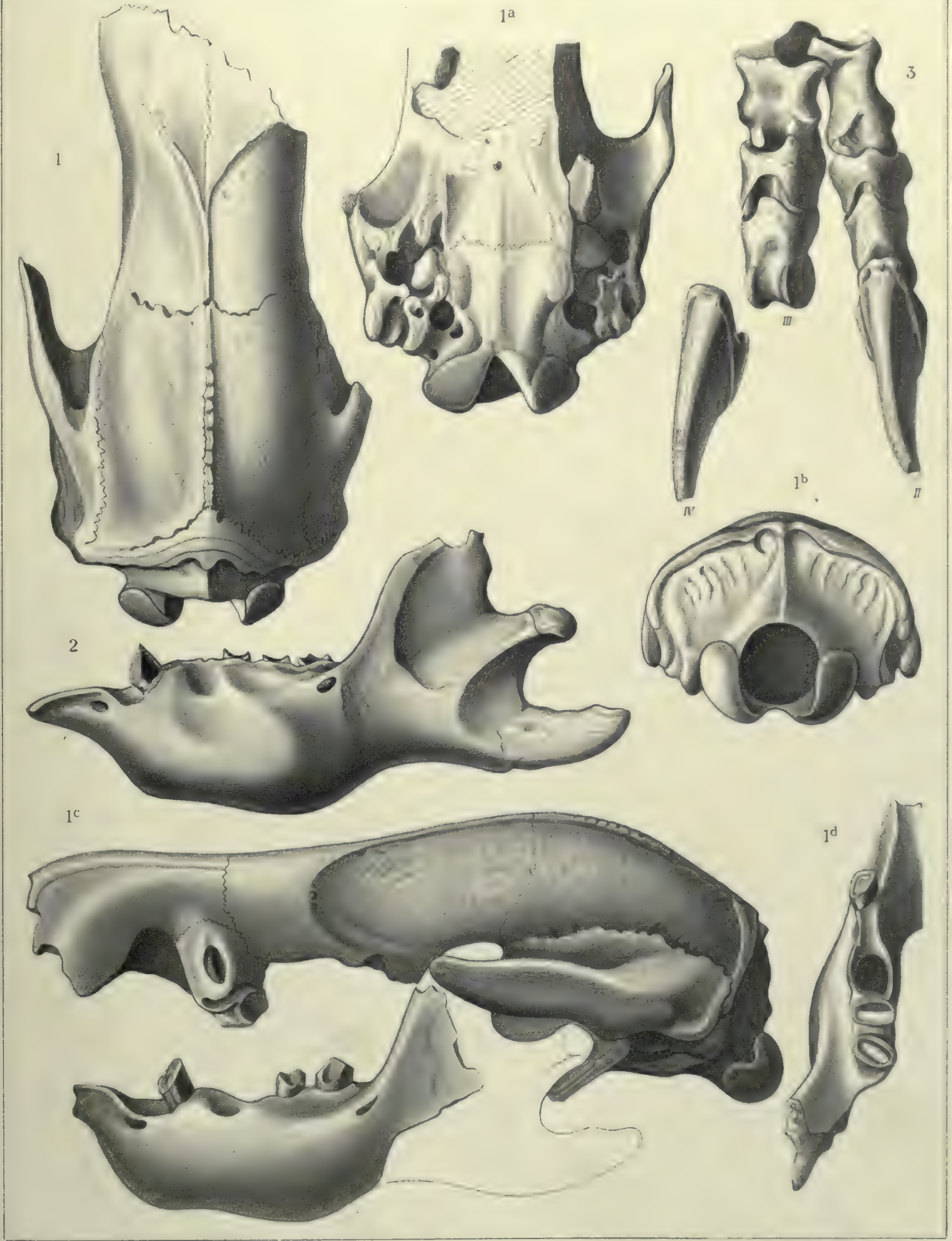
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EUCHOLŒOPS.

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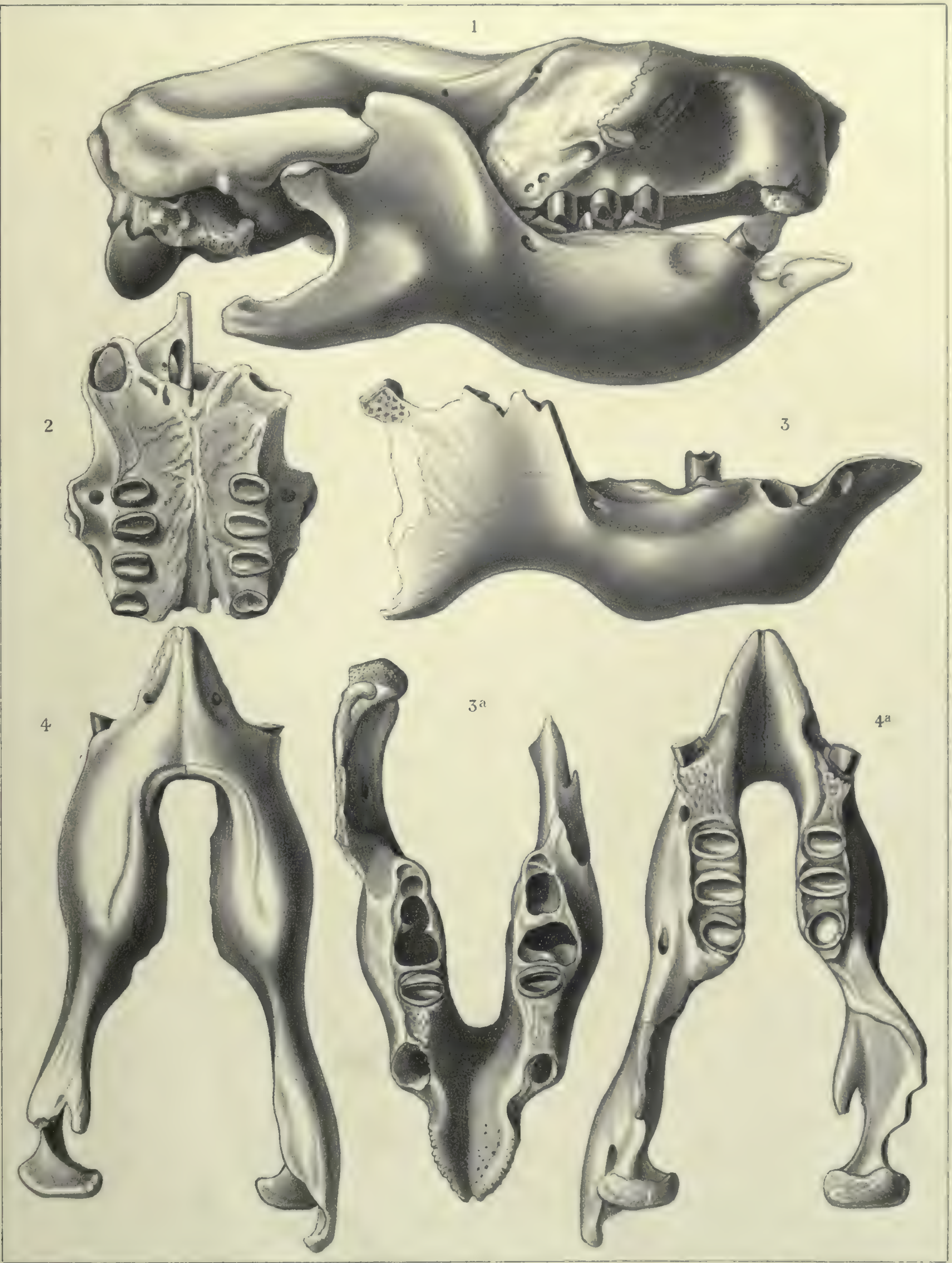

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EUCHOLŒOPS.

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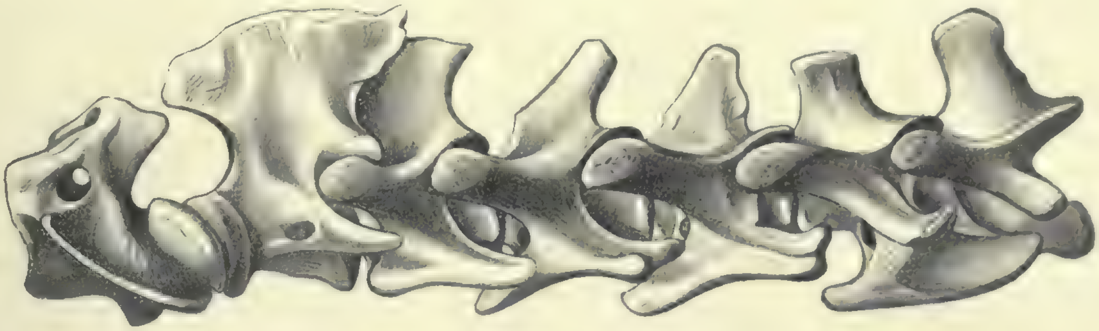

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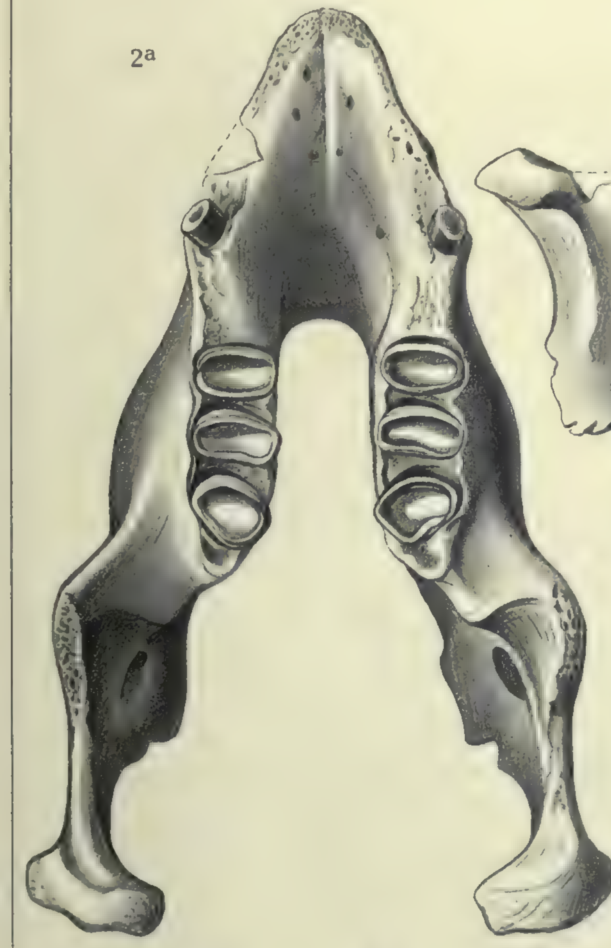

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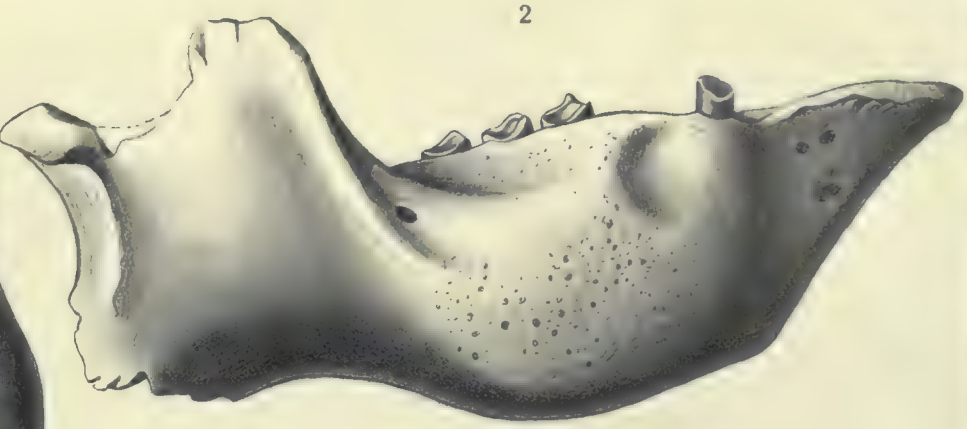

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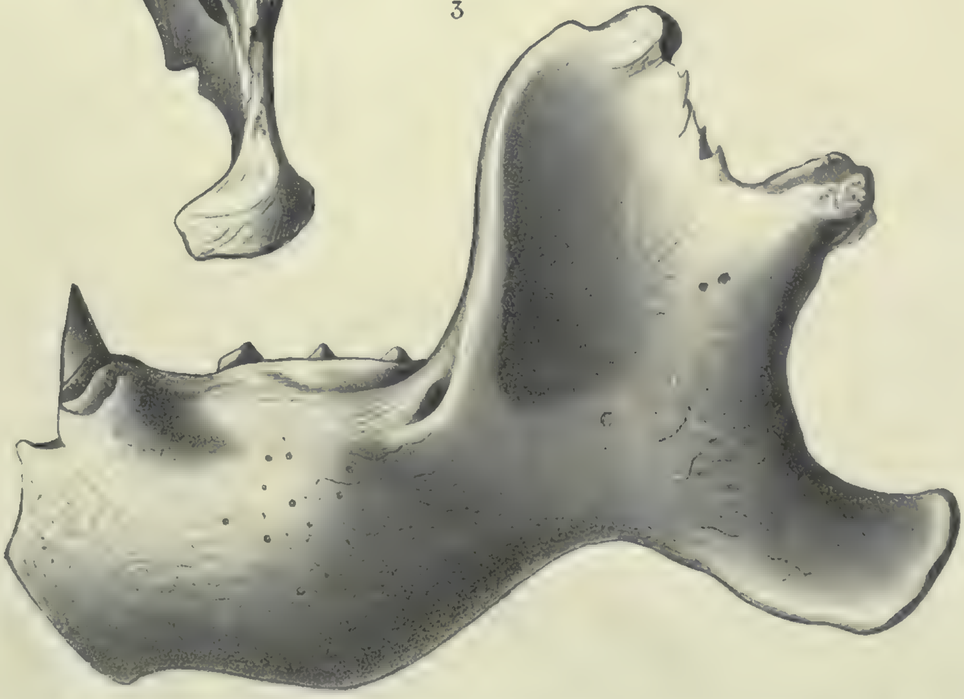

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EUCHOLŒOPS

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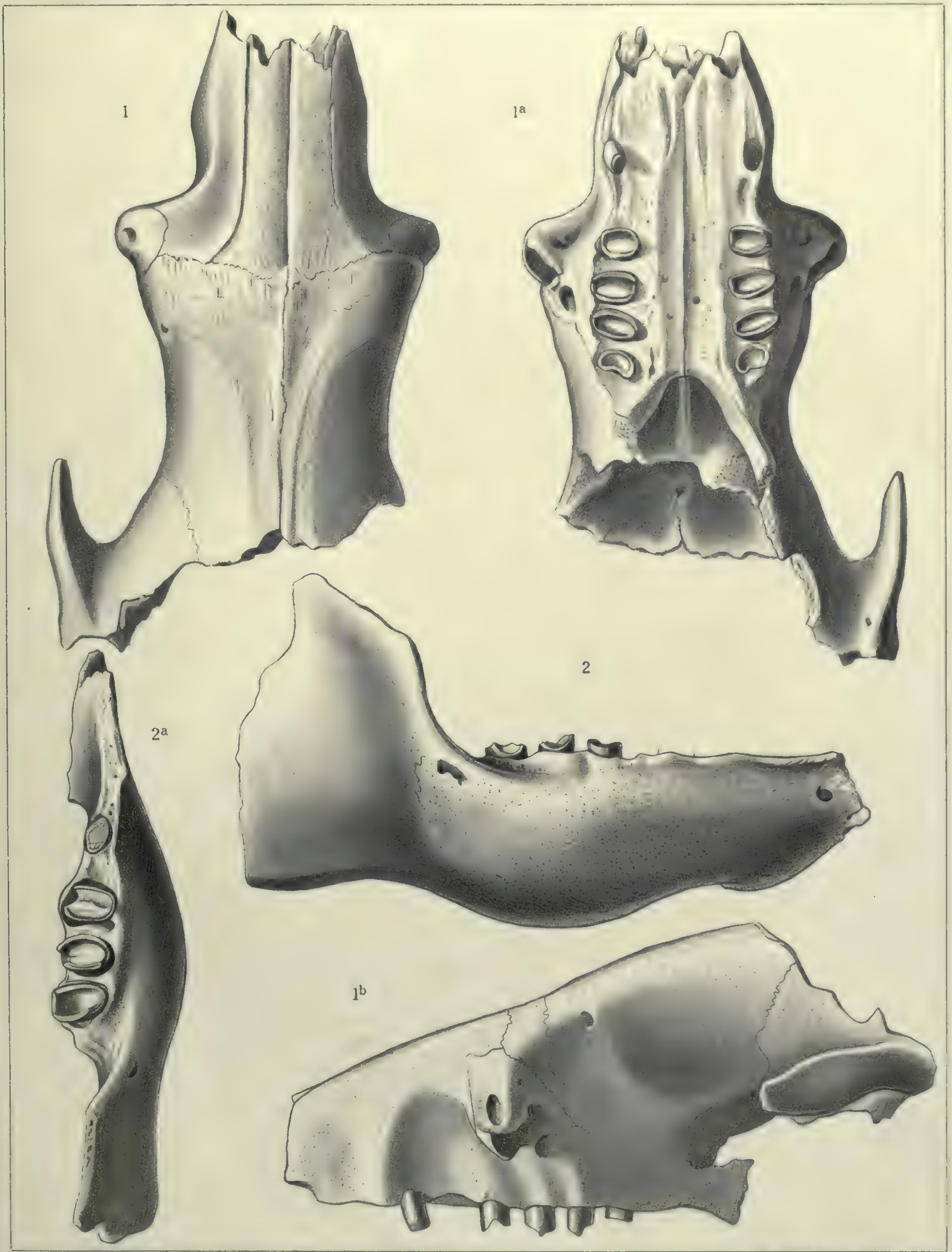

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PLANOPS & PREPOTHERIUM

EXPLANATION OF PLATE LX.

			PAGE
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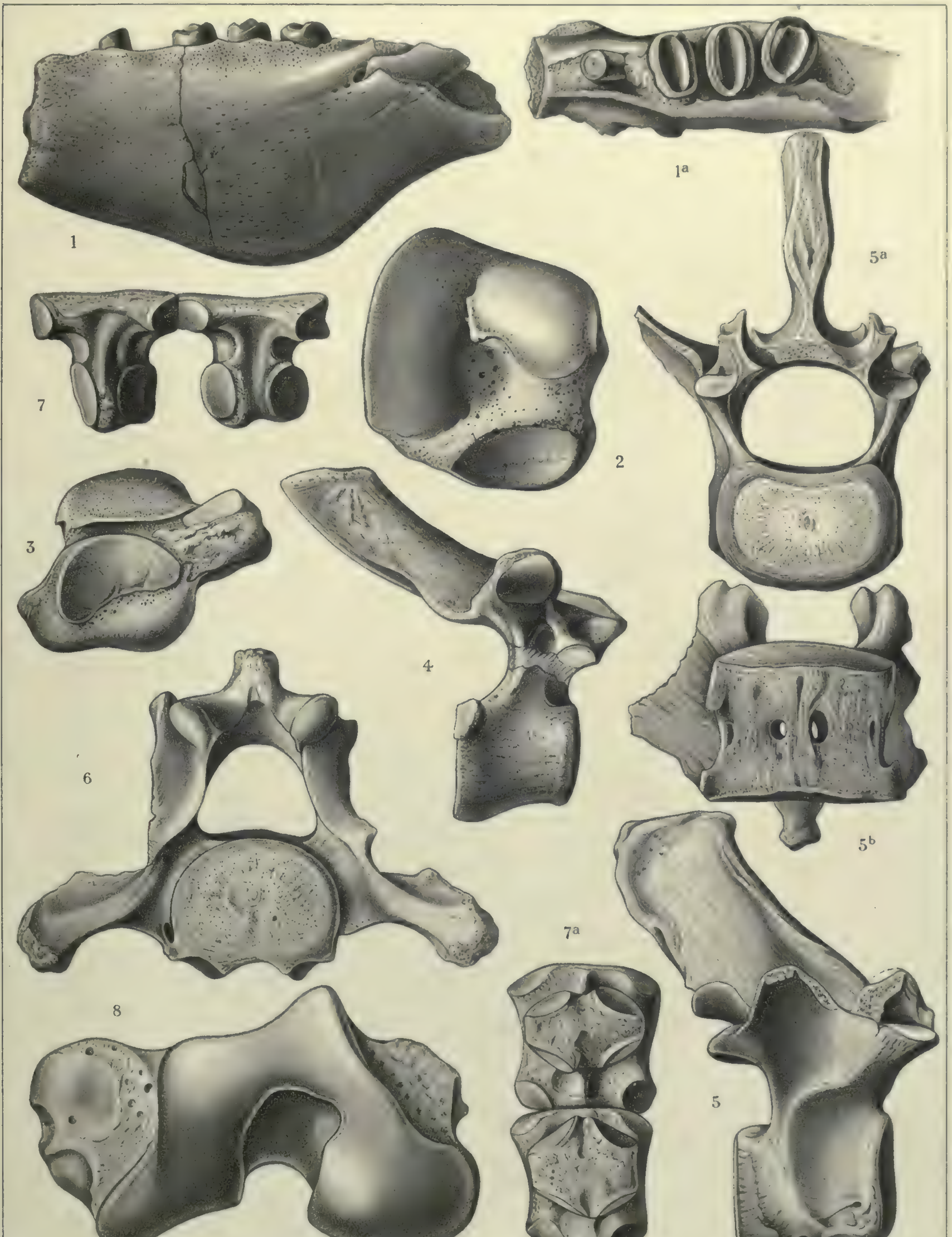
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PREPOTHERIUM

EXPLANATION OF PLATE LXI.

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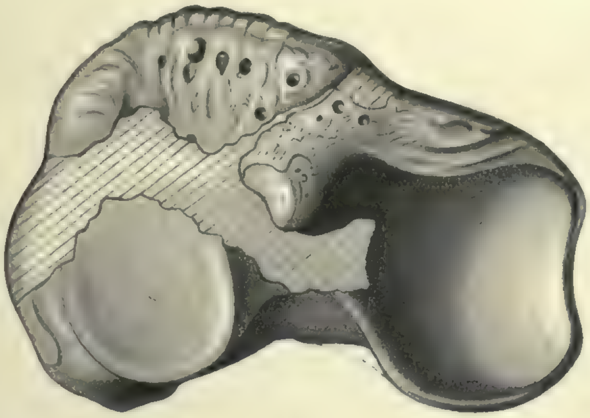

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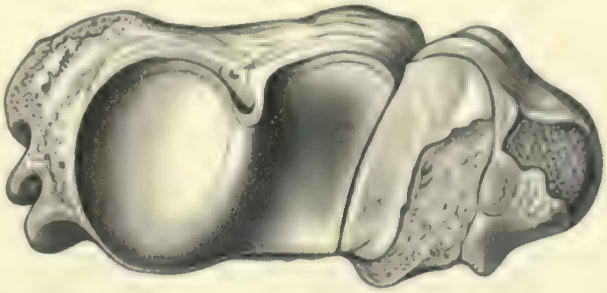

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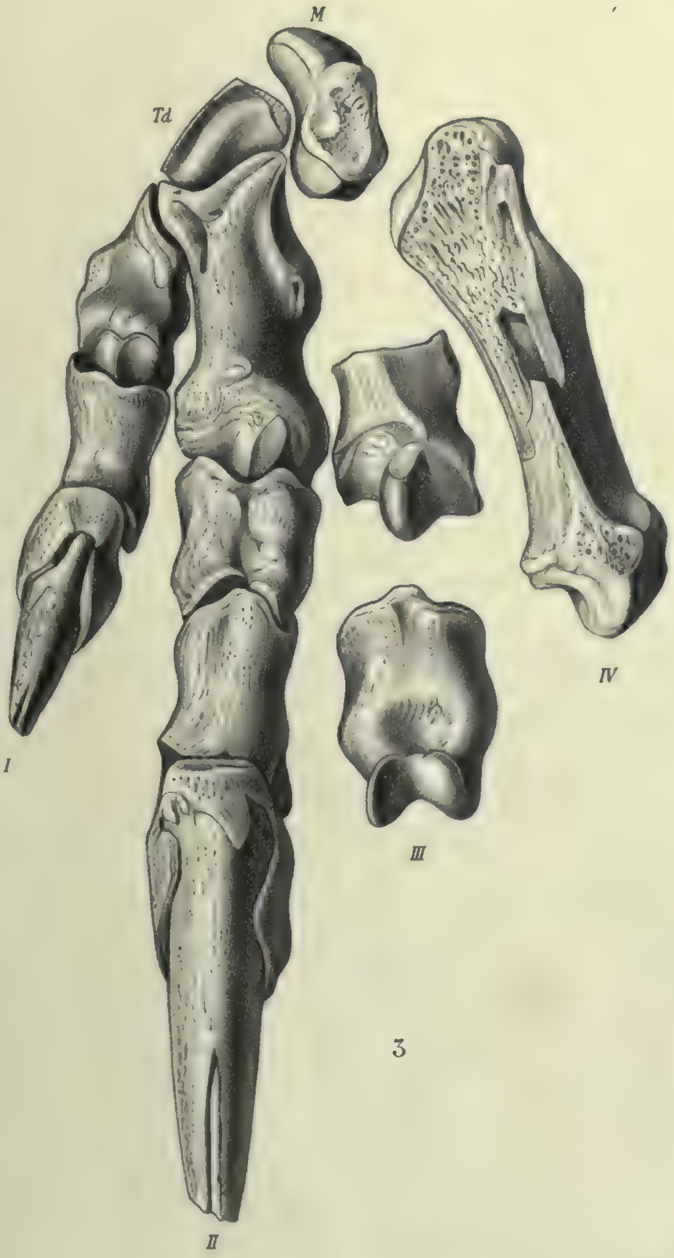
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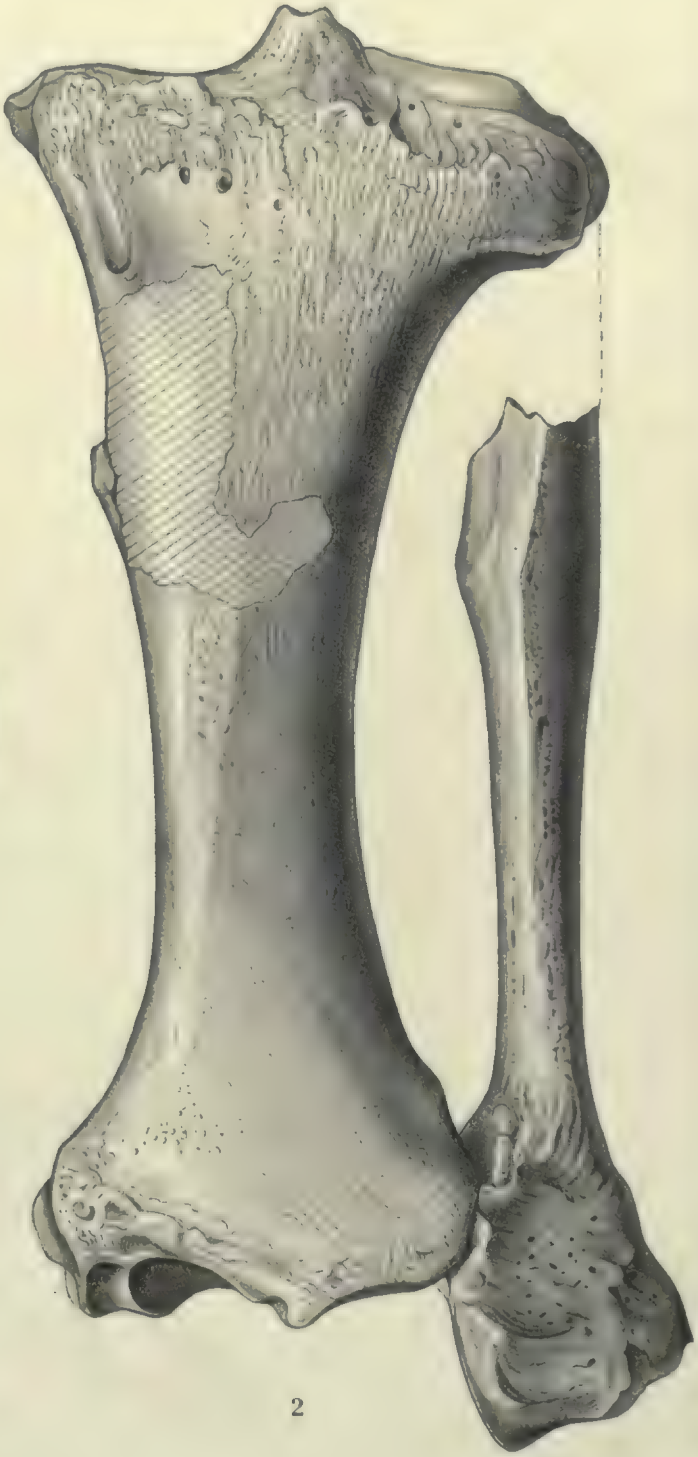

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PREPOTHERIUM

EXPLANATION OF PLATE LXII.

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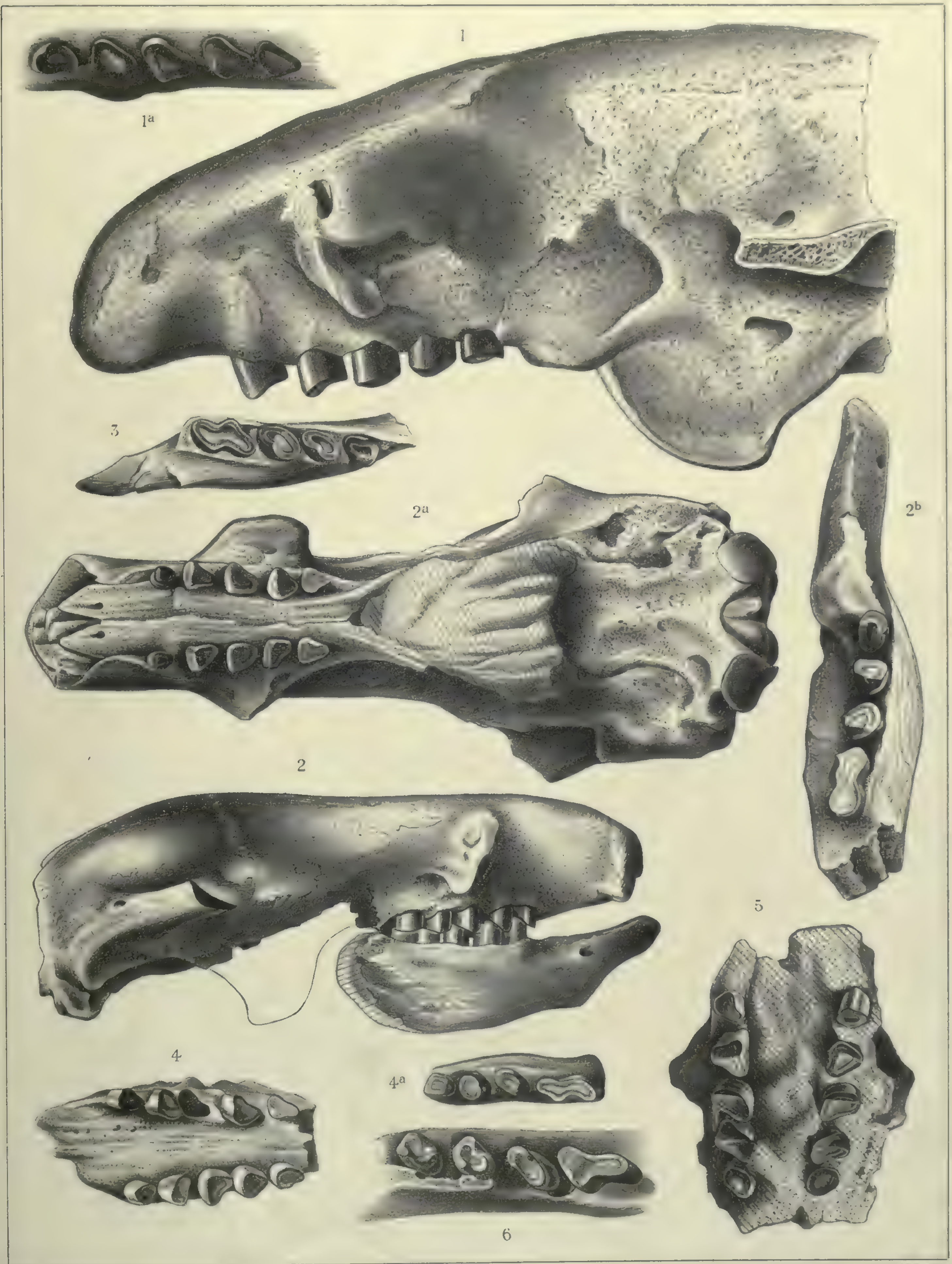
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Werner & Winter, Frankfurt a/M. Lith.

MYLODONTIDÆ

EXPLANATION OF PLATE LXIII.

		PAGE
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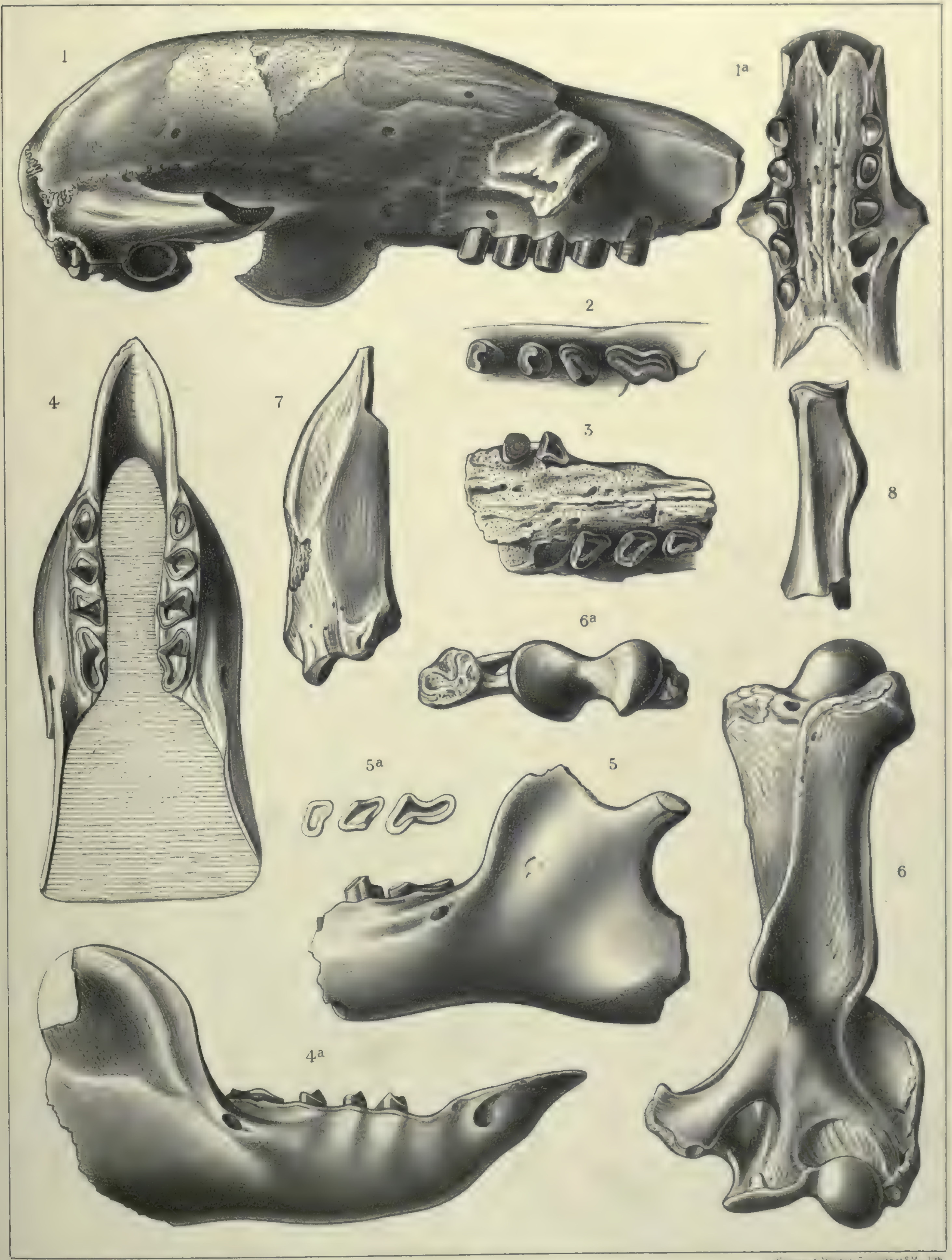
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Werner & Winter Frankfurt a/M. Lith.

MYLODONTIDÆ

EXPLANATION OF PLATE LXIV.

		PAGE
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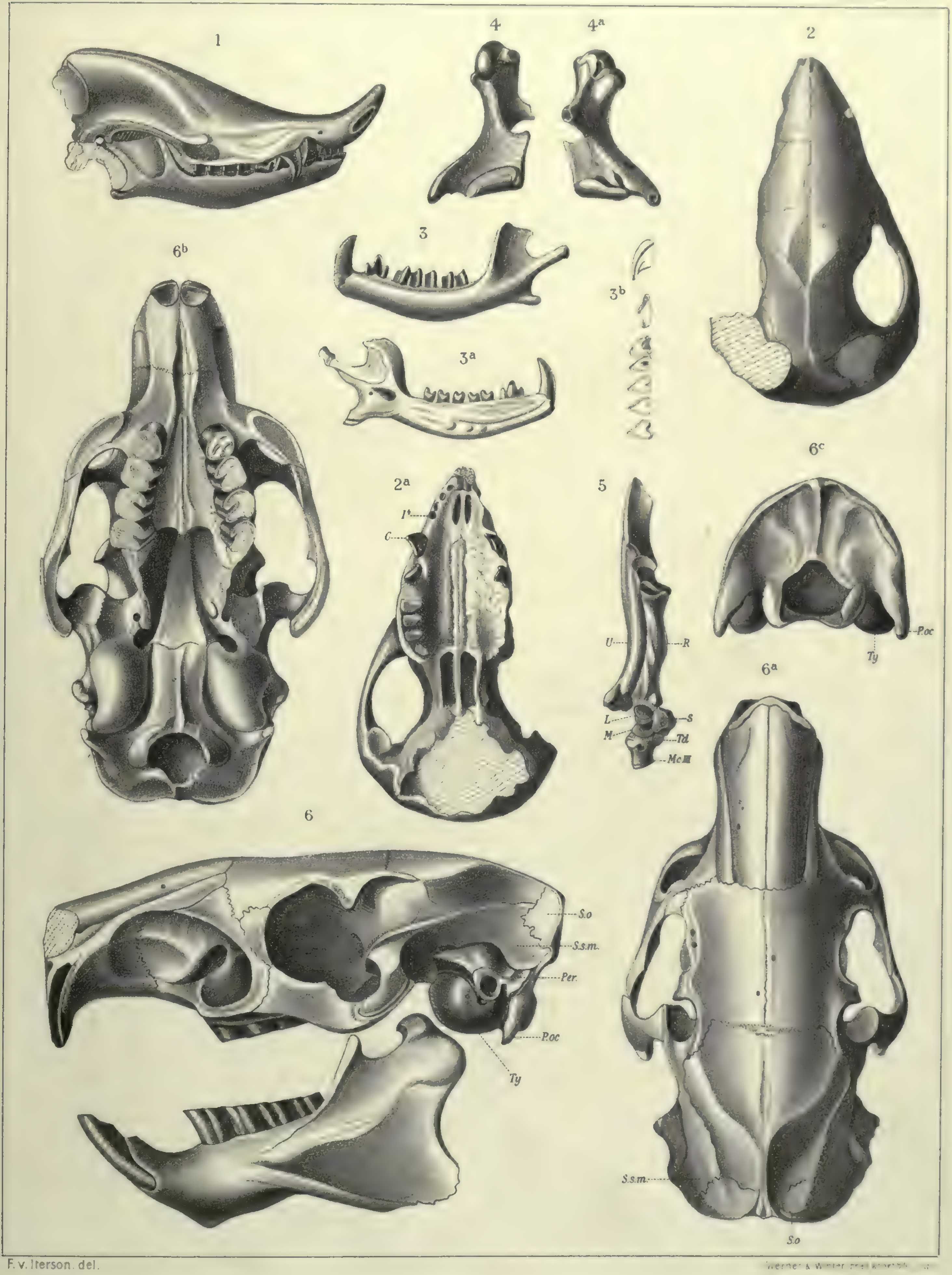
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NECROLESTES & NEOREOMYS

EXPLANATION OF PLATE LXV.

		PAGE
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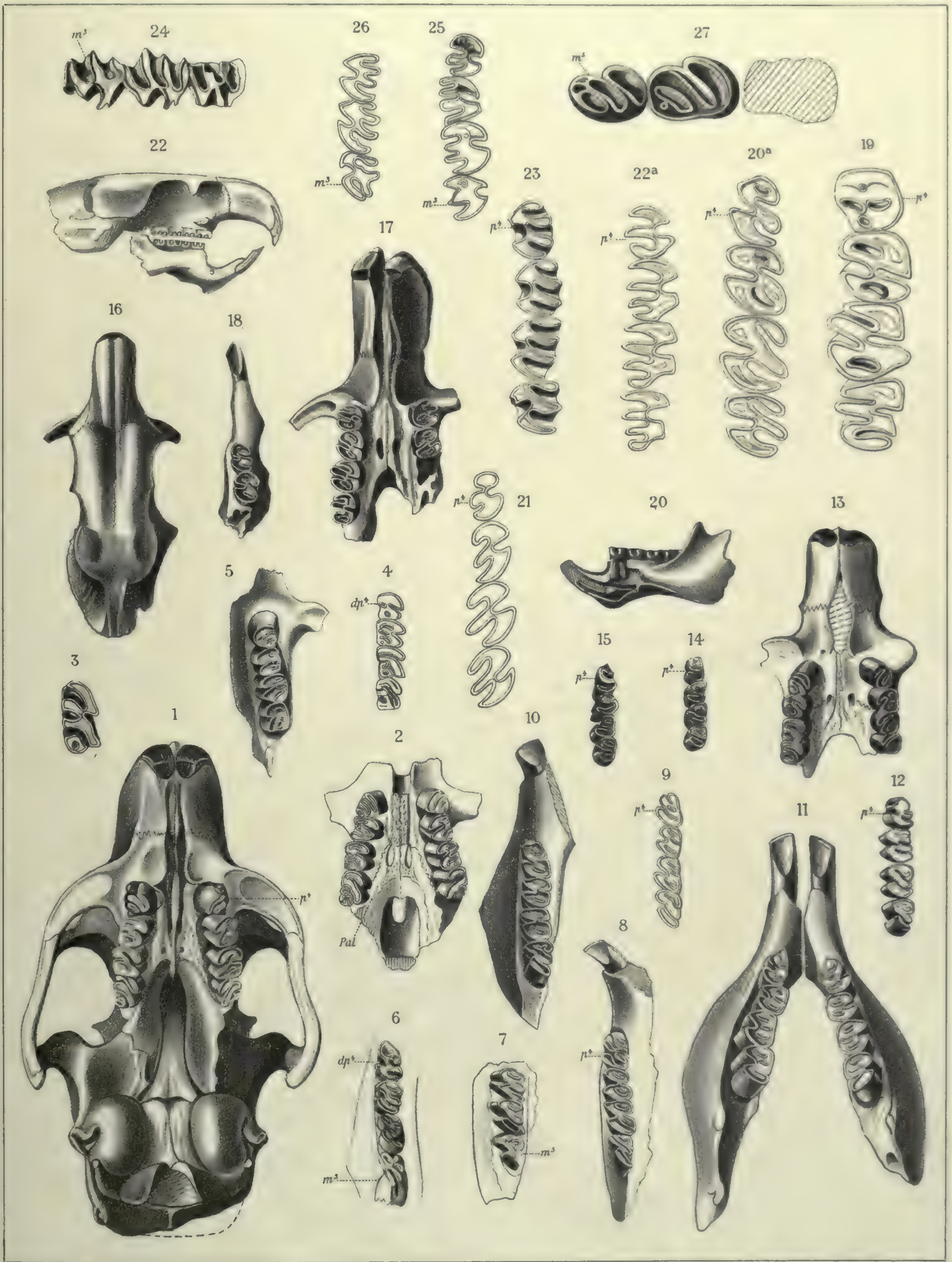
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17
16
18
21
p⁴
20
13
5
4
dp⁴
15
14
p⁴
p⁴
3
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2
10
9
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12
p⁴
11
p⁴
Pal
8
6
dp⁴
7
m³
m³
p⁴

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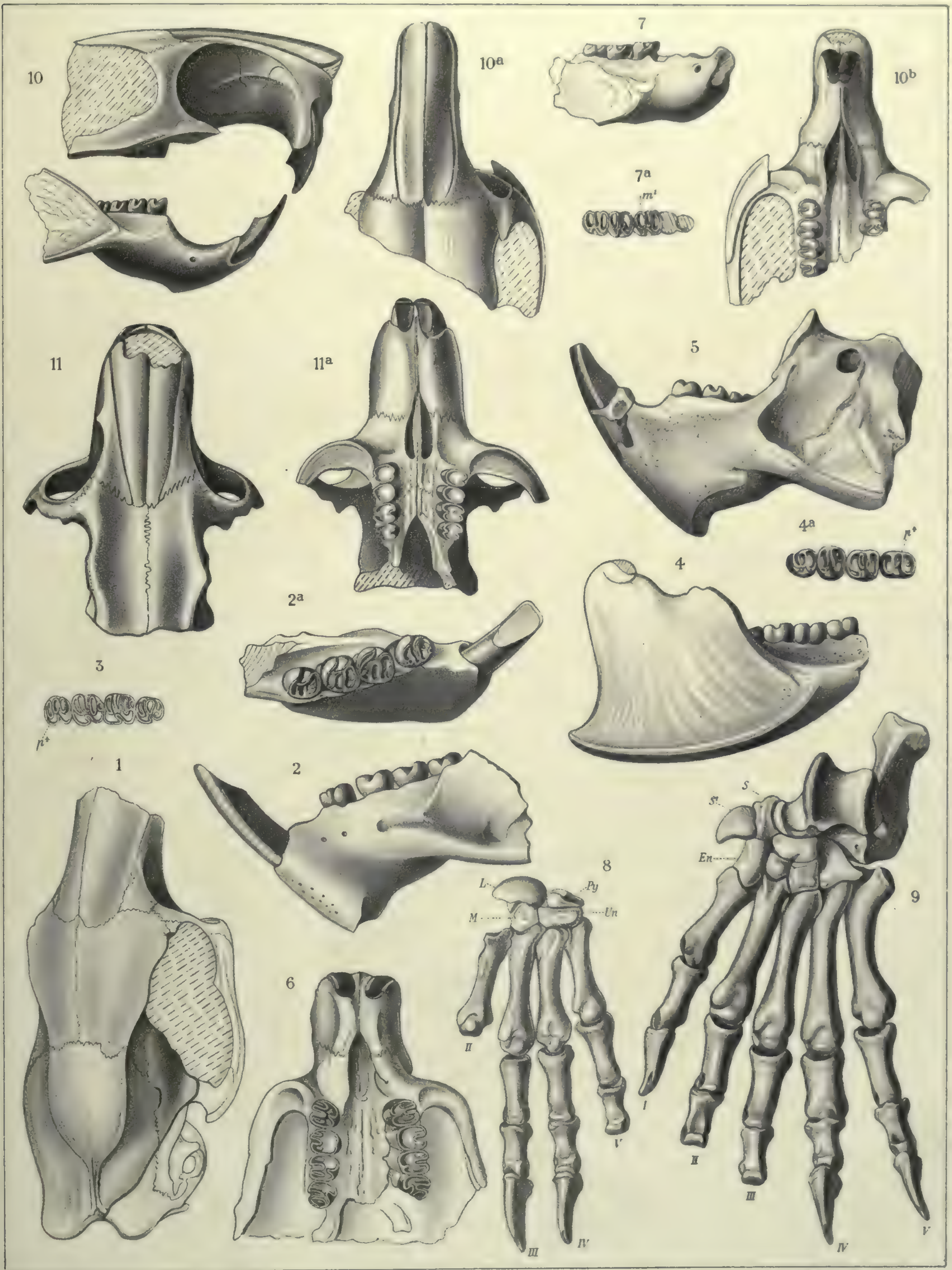
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7^a
m^1
10^b
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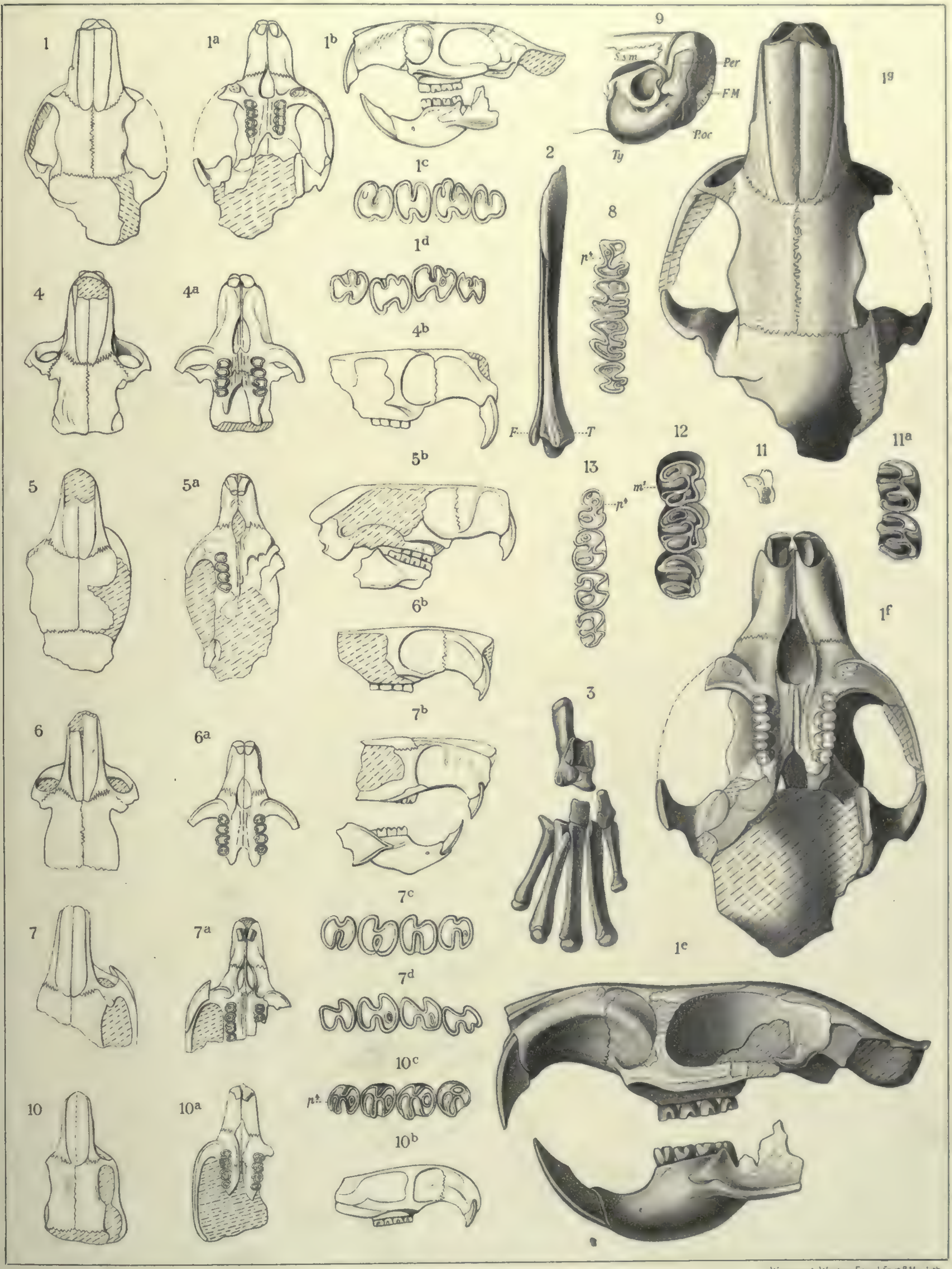
1
1a
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9
Ssm
Per
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1g
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2
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1d
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11a
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m1
p4
5
5a
6b
1f
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7b
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6a
7c
7
7a
7d
1e
10c
10
10a
p4
10b

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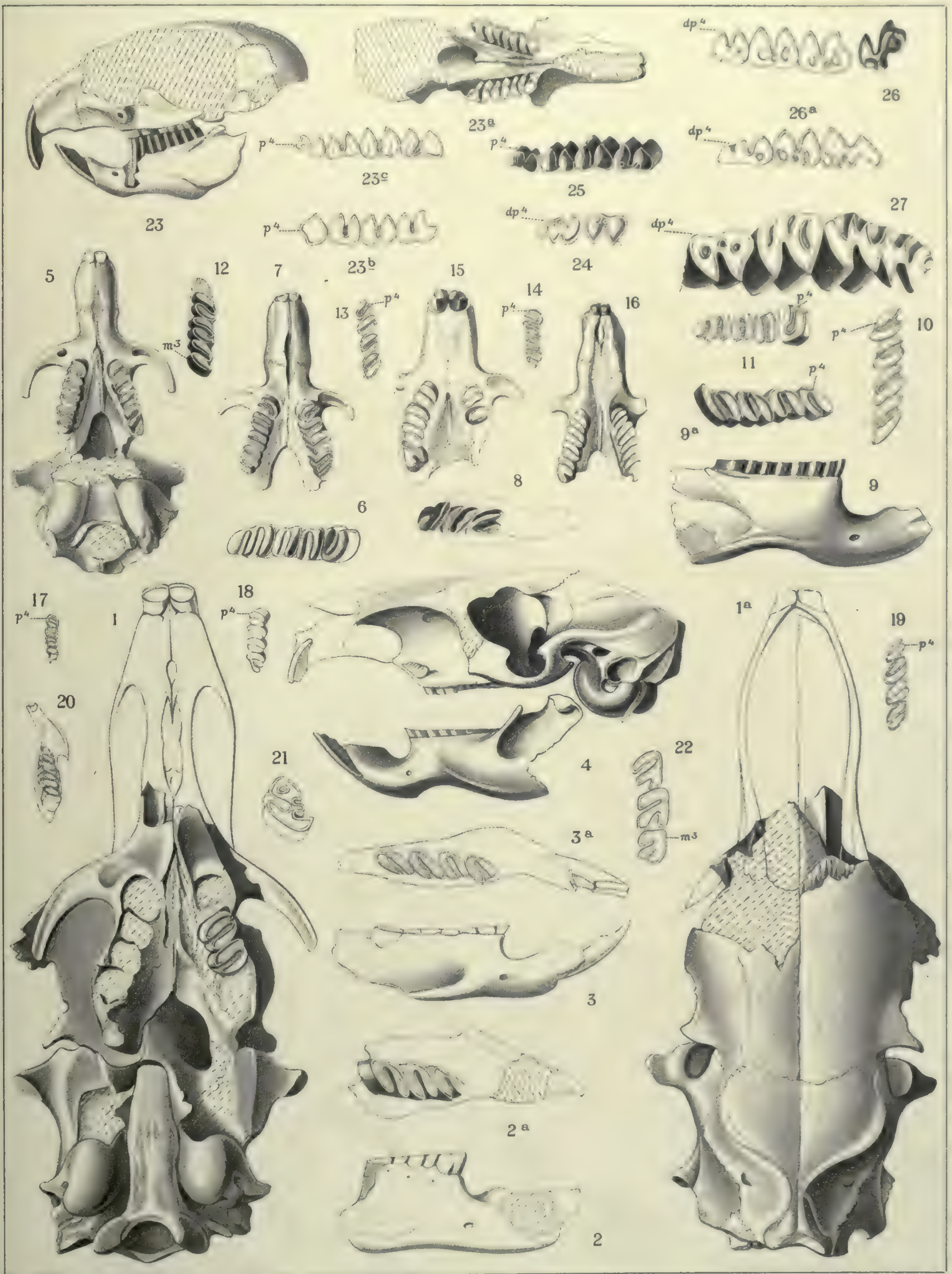
23
23ª
dp^4
26
26ª
dp^4
p^4
23c
p^4
25
27
dp^4
p^4
23b
dp^4
24
5
12
m^3
7
13
p^4
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14
p^4
16
p^4
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p^4
10
p^4
9ª
9
6
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17
p^4
1
18
p^4
1ª
19
p^4
20
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4
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m^3
3ª
3
2ª
2

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N. B. In Figs. 15, 17, 19 and 20 the transverse plates of enamel are made too thick; they should have been indicated by a single line, as in Fig. 18.

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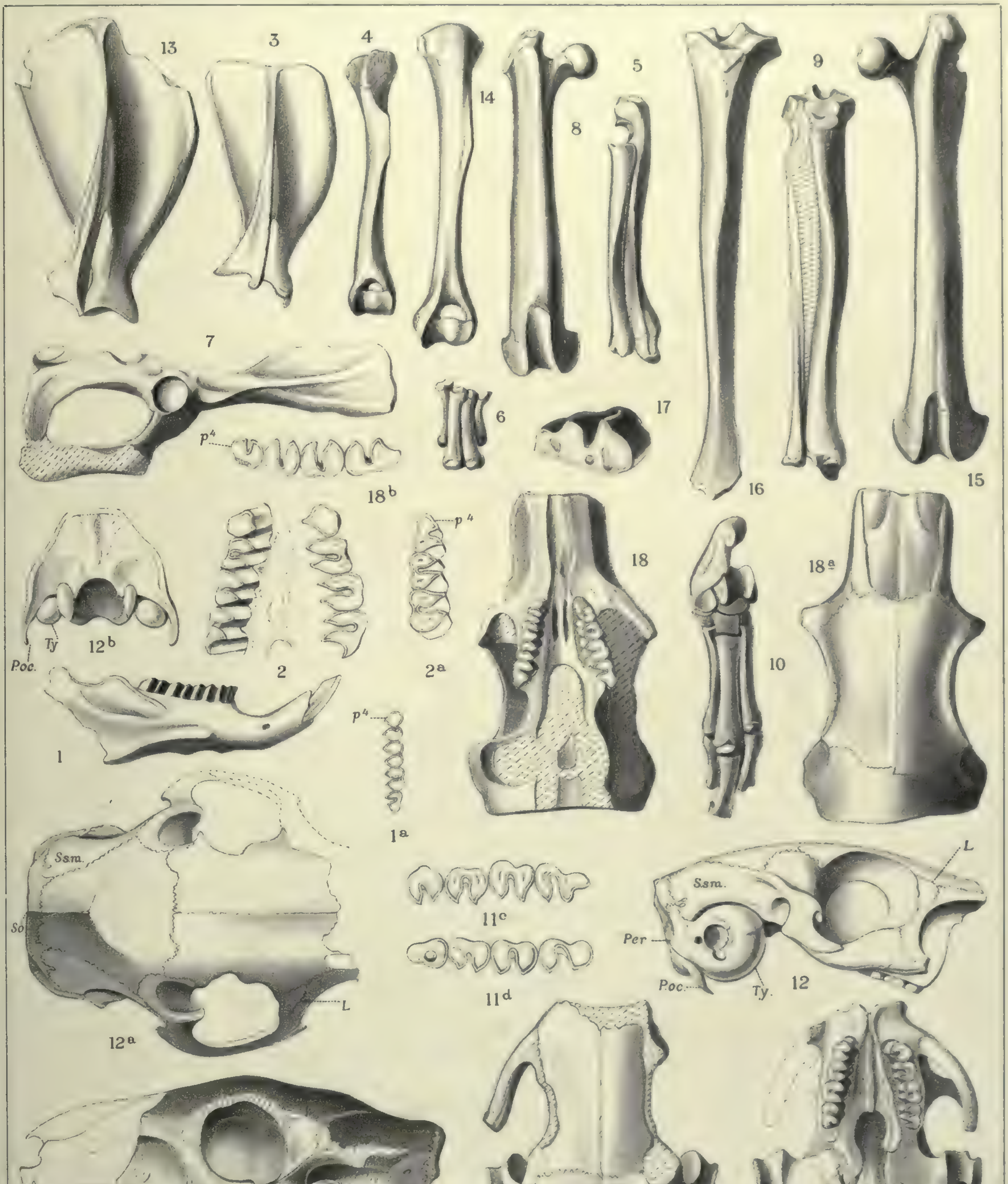
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Werner & Winter, Frankfort a/M., lith.

SANTA CRUZ CAVIIDÆ

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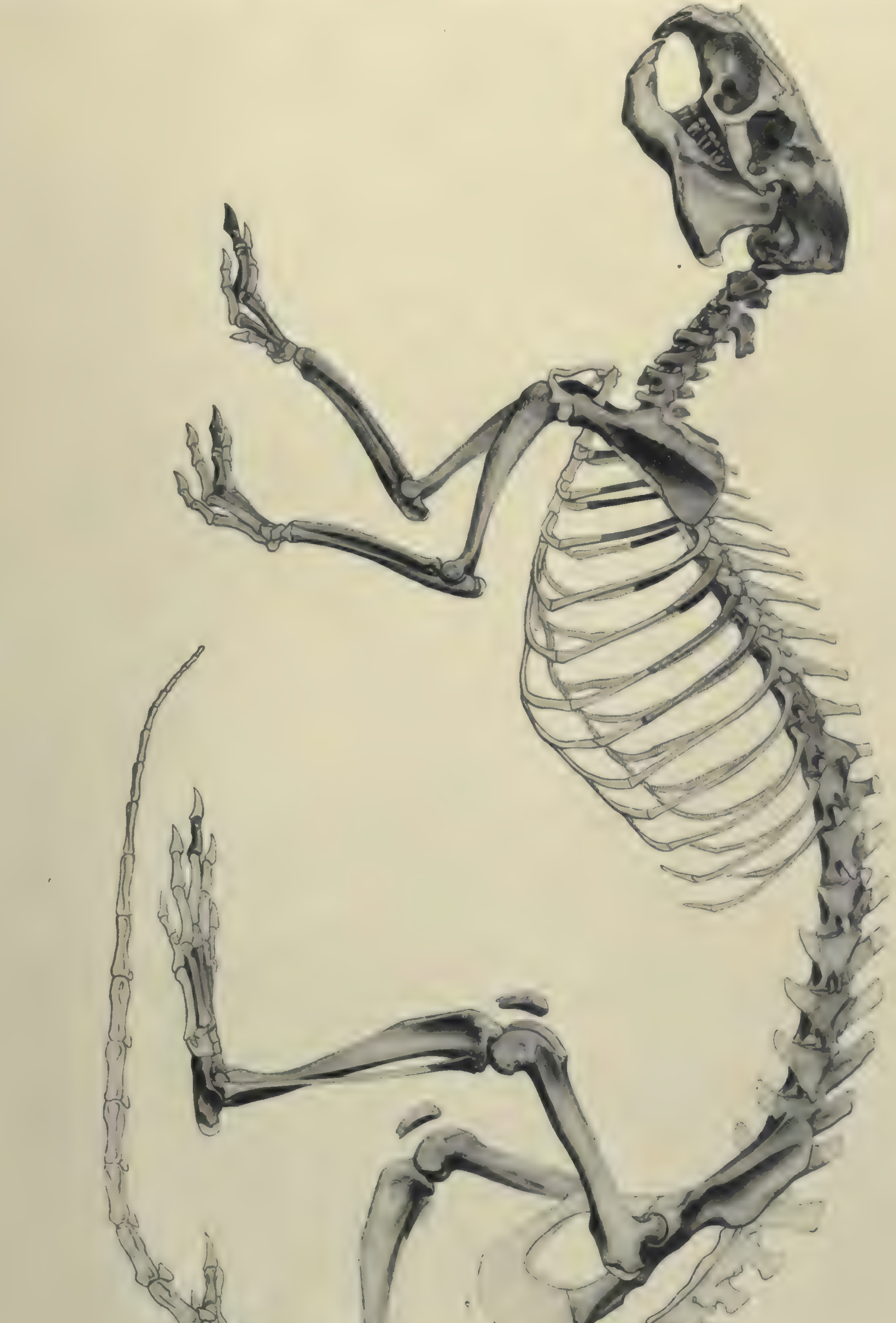

R. Horsfall. del.

NEOREOMYS

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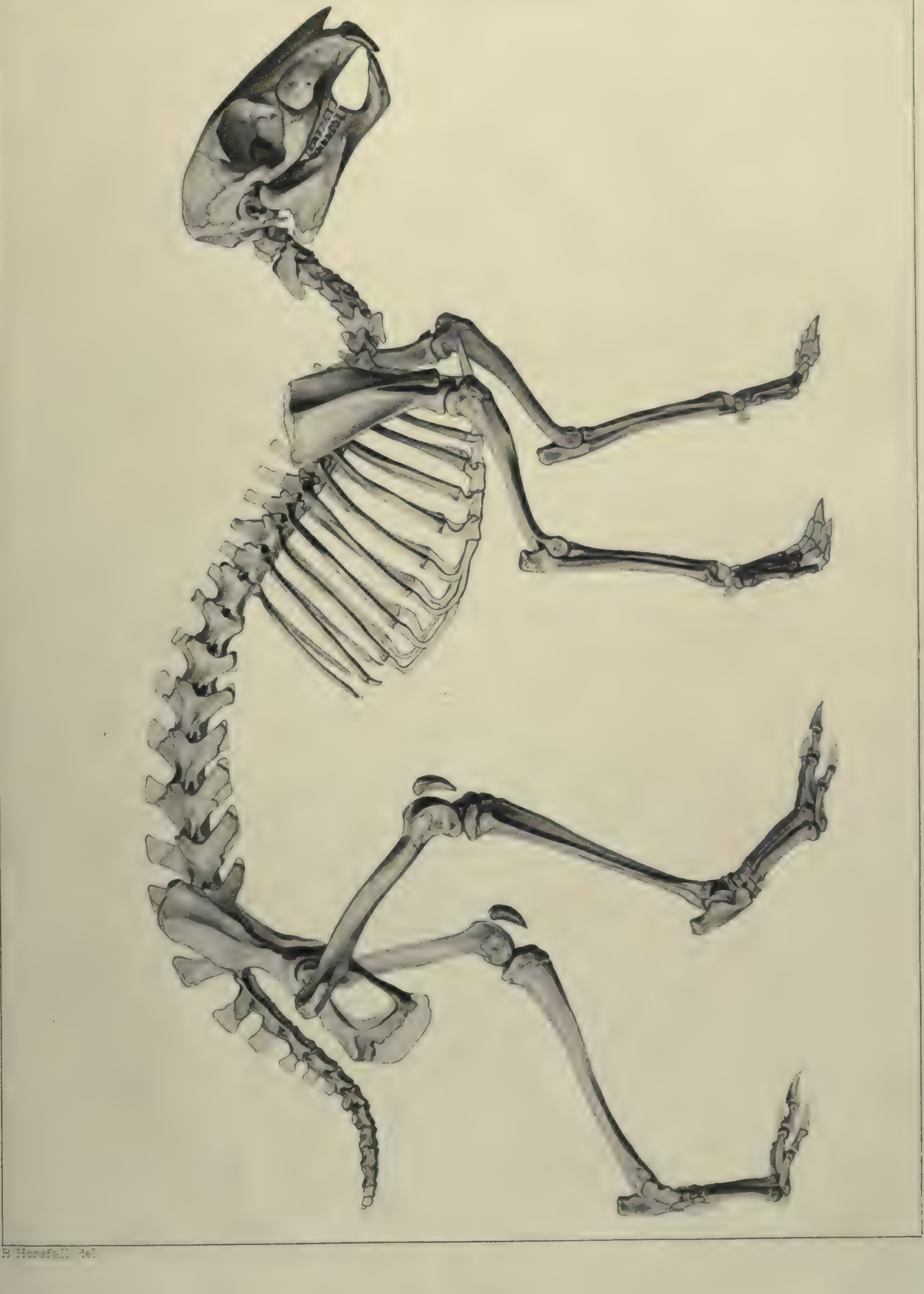

B. Horsfall del.

EOCARDIA.

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